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ELECTRIC POWER SALES IN MANUFACTURING BUILDINGS.

One of the most attractive fields for central-station power service is found in modern buildings occupied by varied manufacturing plants of relatively small capacity. Much good work has been accomplished in introducing electricity into this class of applications. The reasons are not far to seek, since the majority of rented buildings occupied by small manufacturers are usually supplied with power from an inefficient plant, and the cases are few indeed where the losses in belting and shafting are not almost as large if not larger than the amount of power actually used by the tenants in a productive way. Where the same owner controls several factory buildings grouped together within a block or so of the local steam plant, the opportunities for the introduction of the electric motor, fed from central-station mains, are very attractive.

A typical case of this kind drawn from the practice of a station serving a manufacturing city contains several suggestive points. The real-estate interests concerned owned five buildings grouped together in a single block, the total contents being about 821,000 cubic feet, about 760,000 cubic feet being heated by live and exhaust steam. Heating, power and lighting service were supplied to the tenants from a 100-horsepower boiler plant, with a 14-by-42-inch Harris-Corliss engine. The engine was about twenty years old, and its load was carried on two belts, with jack shafts scattered through the structures for the service of the various tenants. Careful tests made by the engineers of the local lighting company showed that the average load on the engine was about eighty-seven horsepower, the friction load of the engine, belts and shafting at noon, when all shop operations were at a standstill, being fifty horsepower.

Before determining the cost of central-station service, it was necessary to ascertain the annual cost of operating the existing steam plant, including every item of expense which could properly be assigned to it. The engineers' examination showed that the boiler and engine were inadequate for the work required of them, it being clear that the existing load could not long be carried without a breakdown which might entail great loss of property, loss of production, and possibly loss of life. The boiler was thirteen years old, and its steam pressure had been reduced to ninety-five pounds on account of the danger of running at higher pressure,

with the prospect of another reduction being enforced by the insurance interests in the near future. In getting at the value of the existing plant, so as to apportion the fixed charges, the engine investment was taken at the original cost, or $2,900, the boiler being figured at half its cost, or $1,000, and the junk value of belts, shafts and pulleys was determined to be $400. The second-hand value of the old engine, $400, was deducted, leaving $3,900 as the present value of the plant.

Interest on the plant at five per cent totaled $195; depreciation at eight per cent on the boiler and five per cent on the balance of the plant figured $225; insurance and taxes on the power-producing equipment came to $75; repairs and renewals, drawn from plant records, came to $750; coal cost, $3,640; water cost, $350 for steam purposes only; labor cost reached $1,872; oil and waste, $118; removal of ashes, $150; and sundries at $50 brought the total cost of service to $7,425 per year, or about $20 per day. The cost determination did not include insurance on the buildings, upkeep of these, the cost of managing the property, water, taxes or miscellaneous expense accruing from their occupancy. The force required to run the plant consisted of one engineer at $21 per week, one night man at $10 per week, and one day fireman at $12 per week. The foregoing percentages were applied to the plant only after a long study of the company's experience in other cases of the same kind, and were accepted by the plant owners as reasonable in relation to the conditions prevailing.

Central-station service was installed in these buildings on the basis of an estimated yearly consumption of 164,700 kilowatt-hours, costing the owners of the property, at 2.6 cents per unit, $4,282. The total cost of maintaining the service came to $6,454 per year, and this included fixed charges upon the boiler and motor installations, fuel, sundries, labor, etc., in addition to the bills of the lighting company. Substantial savings were found to be possible by the use of electricity. Five motors aggregating 8.6 horsepower were originally at work in the plant, and it was found necessary to purchase five more motors having a total capacity of 92.5 horsepower, costing $1,278 at the factory. The motors were required to deliver about twenty-five horsepower less than that indicated by the steam engine, and their cost, in place, was $1,578, the net cost of replacing the belted equipment and engine by motor being $778, allowing for the salvage of the former. Thus the total investment in heat and power-producing equipment with the motor drive came to $1,778. An allowance of five per cent for interest, and the same amount for depreciation on the entire plant—the boiler life being greatly increased by operation at low pressure—totaled $178. The principal items of expense left were coal, for heating only, $1,026, and labor, $800, the only force necessary being a fireman and millwright. Repairs and renewals, sundries, water, oil and waste, and the removal of ashes amounted to $168 and brought the total to $6,454 per year, a saving of $971 per year. Incidental savings effected by the electric drive were two horsepower continuous friction loss in the operation of saws, three horsepower by the elimination of a quarter-turn belt; one horsepower by the shortening of a main shaft; six horsepower by the elimination of shaft distortion, and other small amounts through the installation of clutches. The investigation showed that electric power at 2.6 cents per kilowatt-hour could, under the conditions, compete successfully with a local plant purchasing coal at $4.50 per ton, give improved and more reliable service, and insure better production rates in the establishments of the tenants.

NEW STANDARDIZATION RULES.

The Standardization Rules of the American Institute of Electrical Engineers have been an undoubted help in the development of the electrical industry and a source of assistance to both engineers and manufacturers. In order to be of the greatest value it is essential that they should be modified from time to time in accordance with the latest developments of science and industry, and a standing committee of the Institute gives almost constant attention to suggested amendments.

At the annual convention of the Institute in 1910, a revision of the rules was submitted for consideration and discussion but no action was taken at that time. Since then new material has been brought forward, and at the convention in Chicago last June, final action was taken by the Board of Directors and the revised rules were adopted. These rules have been published in the issue of the *Proceedings* for August. Some of the new material has not had the benefit of general criticism and has probably suffered thereby. It is to be regretted that the entire list of changes was not submitted to the membership for criticism in accordance with the resolution adopted at the Jefferson convention.

The new material consists largely of definitions, although important changes are to be noted under ratings and in the appendices on photometry and temperature coefficients. The latter have been revised in agreement with the latest investigations in this subject, and different values are now given for materials of different conductivity. It should be remembered also that a similar relation between temperature coefficient and conductivity exists for other metals, such as aluminum, iron, etc., as well as for copper.

Some of the definitions in the new code will not appeal to the reader as particularly helpful, as, for example, "two immediately succeeding half-waves constitute a cycle." This will stimulate his gray matter, however, in the attempt to distinguish between a cycle and a wave.

The definition of form-factor is unfortunate in stating it to be the ratio of the effective value to the arithmetical mean value, taken *without regard to sign*. In the exceptional cases where a wave passes through the value zero more than

twice per cycle, this definition destroys the usefulness of the quantity under consideration. The form-factor is important because it connects the maximum value of magnetic flux which periodically links any coil with the electromotive force induced in the coil. In order to have this relation hold in all cases, it is necessary, as pointed out in these columns a year ago (August 27, 1910, page 407), to consider the *algebraic* average over a half period beginning with the value zero. If the *numerical* average be taken, the form-factor defined by it loses all significance in the special case above noted.

SIGN LIGHTING.

The use of tungsten lamps for sign lighting not only greatly reduces the cost of power but adds to the attractiveness of the sign by reason of the quality of the light. The whiteness of a sign equipped with tungsten lamps contrasts very favorably with the yellowness of its neighbor which is burning carbon lamps, and as attractiveness is a leading feature in advertising, the importance of this element should not be neglected by those engaged in the installation of electric signs.

Where the current supply is alternating it is usually preferable to make use of tungsten lamps of low voltage in connection with a transformer of suitable ratio. With a direct-current supply the reduction of the line voltage cannot be done in this way, and it becomes necessary to consider other means of utilizing a low-voltage lamp. Low-voltage lamps are unquestionably better suited for sign purposes than those rated at usual line voltages. In all sign work it is preferable to use units of small candlepower, and to mount these close enough to give as great continuity to the lines of the sign as possible. Many signs are inadequate in this respect, the lighting units being so far separated that it is difficult to distinguish the letters. Lamps of low candlepower will naturally be of low voltage, and it becomes necessary on direct-current circuits to connect a number of lamps in series. There has been considerable trouble in the past from the operation of low-candlepower metal lamps in series, owing to the fact that the lamps chosen for series operation have not been rated at exactly the same current and consequently burn-outs have been frequent, not only causing considerable expense for renewals but interfering very greatly with the satisfactory appearance of the sign. The operation of lamps in parallel-series, that is to say with a number of parallel groups connected in series, has reduced this difficulty to some extent, but has not entirely obviated it, since a burn-out in one group necessarily changes the current flowing in other lamps. Probably the most satisfactory method of operation is to connect lamps in a simple series circuit, and to place such a number of lamps in series that the rated voltage for the group will be several per cent in excess of the line voltage. All the lamps are in this way operated at slightly less than the normal voltage and the danger of burn-out becomes much reduced, while the quality of the light is not greatly affected. This method, where tried, has given general satisfaction, and those central stations which have adhered to the use of carbon lamps for low candlepowers on account of the trouble above referred to, will find this method of operation with tungsten lamps a decided improvement upon the use of carbon lamps.

Another detail in the operation of signs which needs attention is the rate at which flashers are operated. The use of a flasher not only serves to attract attention to the installation, but results likewise in a considerable saving of the energy consumption. Many signs, however, are flashed with such frequency that it is hard for the eye to recognize the entire wording of the sign before the lamps are extinguished. In some cases this is so marked that none but those observers who make a persistent effort to read the sign are impreseed by its message. Others are impressed merely by the existence of the sign, without taking notice of the wording. This is more especially the case where the rapid flashing is combined with letters in too close juxtaposition, or made up of too few lamp units of large size. An increase in the time of the flash will be found advantageous in a great many cases, even where the time of darkness is proportionately increased, so that the total consumption of energy is not changed.

WATER BAGS VERSUS ELECTRIC FANS.

When the intense heat wave of the early summer was being felt throughout the country, some of the newspapers vied with one another in suggesting plans by which their readers might lessen the effects of the heat on themselves. These included various suggestions for cooling off when an electric fan was not accessible, such as wrapping one's self in towels dipped in cold water—a practice which could only afford relief for a short time, while even a small-sized fan would continually add to the comfort of the owner. Another recommendation and one that appealed more strongly to the women was the use of rubber "hot-water bags" filled with cold water or even with ice water. Unfortunately this was taken seriously by many who did not stop to consider the possible effects of the local chilling due to such an application. Among these was a young woman living at Englewood (one of Chicago's suburbs) who traded her usual downy pillow for a rubber bag filled with cold water, not even using ice water for the purpose. She fell asleep speedily, only to find on awakening that the left side of her head (which side had rested on the chilled bag) was partly paralyzed and badly distorted. Immediate attention by Dr. E. R. Reynolds, of the Mercy Hospital, availed but little, though a few weeks' treatments are said to have somewhat relieved the disfiguration and the accompanying difficulty of articulation. Evidently the chilled-water bag is an exceedingly dangerous substitute for an electric fan, which remains supreme in its field.

Meeting of the Central Electric Railway Association.

The fourth meeting of the Central Electric Railway Association will be held at Cedar Point, Ohio, August 23 and 24. The morning program for the first session consists of the reading and discussion of papers. The first will be presented by Adolph Schlessinger, superintendent of overhead construction of the Terre Haute, Indianapolis & Eastern Traction Company on "Overhead Standardization," and Oliver E. Anthony, baggage agent of the Indianapolis Traction Terminal Station will read a paper on "Troubles of a Baggage Agent."

Subsequent sessions of the two days' meetings will be given up to business matters and the reading of a paper by Henry N. Staats, expert of the Central Electric Railway Association and the American Electric Railway Association on "Insurance."

"Little Things," will be the subject of a paper to be read by J. C. Schade, assistant secretary-treasurer of the Winona Interurban Railway Company of Warsaw, Ind.

The social features of the meeting will consist of outings, lake excursions and an informal reception or ball. A large number of Indiana and Ohio tractions officials are planning to attend the meeting. A. L. Neereamer, of Indianapolis, is secretary.

Indiana Railways Improve.

The members of the Railroad Commission of Indiana declare that the laws, relating to the safety of travel and train service on interurban lines, enacted by the recent Legislature are doing much toward diminishing injury and fatal accidents on interurban trains in Indiana.

The members of the Commission attribute the decrease in accidents on interurban roads largely to the better class of men now being hired as motormen and conductors. They commend that provision of the law requiring traction officials to hire as motormen only those persons who have had at least one year's experience in interurban train work, and that provision, strongly opposed at first, has done much, the Commission says, to save life and limb on the interurban roads of the state.

The members of the Commission say that the casualty rate on the steam lines are much higher than on the interurban lines. During the first quarter of the year the rate was nearly fifty per cent lower on interurban than on steam lines. The data for April, May and June, now in the hands of the printer, show a still greater discrepancy in favor of the interurban roads.

Railway Situation in Cleveland.

The Socialist party has filed a referendum petition with 15,000 signatures in regard to the proposed changes in the Tayler Grant under which the Cleveland Railway Company is now operating. It will be two or three months before the election can be held as it will probably be postponed until the fall municipal election. This petition will cause a corresponding delay in the improvements which the Railway Company was to undertake and will postpone the financing of these requirements. It is quite possible that the extra power required by the Railway Company will be supplied by the Cleveland Electric Illuminating Company, which has a new power plant approaching completion.

Freight Rates on Electrical Goods Lowered.

The Interstate Commerce Commission, in its decision against the Atchison, Topeka & Santa Fe Railroad Company, in the complaint brought by the Commercial Club, Traffic Bureau, of Salt Lake City, Utah, has lowered both the class and commodity rates maintained by the carriers between Chicago, Ill., Mississippi River and Missouri River rate territories and Salt Lake City, Provo, and Ogden, Utah. It was decided after a very lengthy consideration of the matter and many hearings, that the present rates are unjust and unreasonable. and it has prescribed what shall be the maximum for a period of not less than two years from November 15, 1911, for a large commodity list, and among them, provisions are found for the following items:

Insulators, terra cotta, clay, glass, or porcelain, including insulators similar to conduits, for use in buildings for protection against fire; also telegraph pins and brackets, in boxes, barrels, crates, or hogsheads, minimum carload weight 30,000 pounds; from Chicago and Chicago territory, $0.90; from Mississippi River territory, $0.86; from Missouri River territory, $0.72.

Anchor rods for telegraph or telephone poles, or iron or steel, minimum carload weight 30,000 pounds: Chicago territory, $0.80; Mississippi River territory, $0.77; Missouri River territory, $0.64.

Indiana Electric Light Association.

Elaborate arrangements are being made for the fourth annual meeting of the Indiana Electric Light Association to be held at the Oliver Hotel, South Bend, August 23 and 24, 1911. The opening session will be taken up by the annual address, by president F. A. Bryan, of South Bend. After adjournment at noon the members and visitors will be carried on special cars to Berrien Springs, Mich., where a buffet luncheon will be served under the waterfall of the dam. After inspecting the hydraulic plant the trip will be resumed to St. Joseph, Mich., where the afternoon session will be held at the Edgewater Club.

Papers will be read and discussed on the following subjects: "Heating in Connection with Central-Station Work," by John Hornung, of Chicago; "Economies of Operation Secured by Consolidation of Small Properties," by L. B. Andrus, general superintendent, Indiana & Michigan Electric Company, South Bend; "Power," by R. A. MacGregor, manager, Light, Heat & Power Company, Connersville, Ind.

Thursday morning the meeting will again convene at the Oliver Hotel, South Bend, and the following program carried out: "Rural Service," paper by C. E. Lawton, Lebanon, Ind.; "The Steam Turine for Future Work" (illustrated), by E. D. Dreyfus, commercial engineer, Westinghouse Machine Company; "Affiliation with the National Association," by John F. Gilchrist, president of the National Electric Light Association; "Illustrated Talk on Curtis Steam-Turbine Installation," by G. R. Parker, General Electric Company.

Iron and Steel Exports Increase.

An increase of over $51,000,000 in the exports of iron and steel manufactures and a decrease of over $4,000,000 in the imports of this class of merchandise are striking characteristics of the foreign commerce of the United States in the fiscal year just ended. Iron and steel manufactures exported aggregated $230,725,351 in value, against $179,133,186 in 1910 and $183,982,182 in the former high record year, 1908.

In electrical machinery there has been an increased exportation of $2,000,000. The amount given for the present year is $8,000,000 as compared with $6,000,000 for last year.

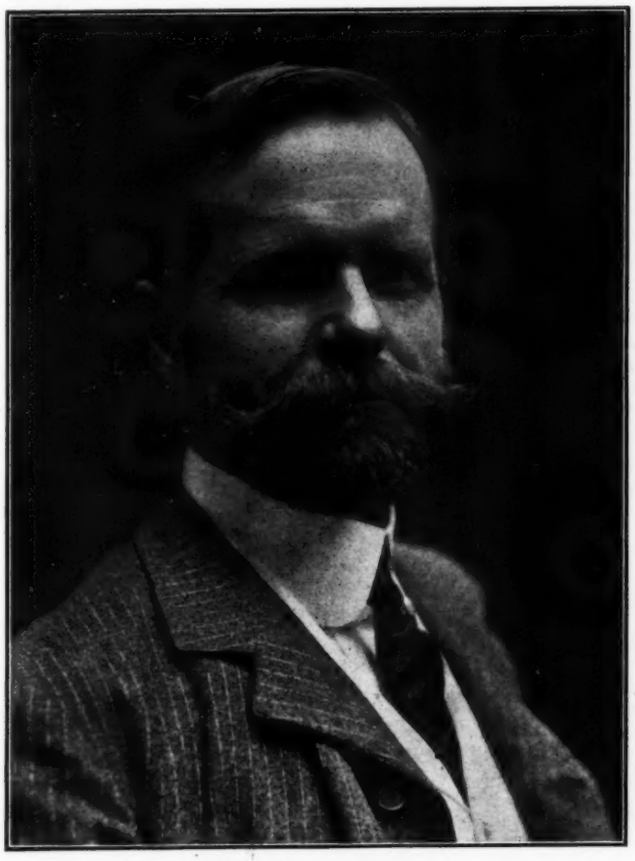
William J. Hammer.

In speculating upon the present greatness and the all-encompassing scope of electrical achievement, one naturally turns the mind back to those who in the early days loomed large as important and impressive personalities in the working out of the initial problems that ushered in our great industrial conquest. Among those who had much to do with placing upon a substantial footing the earliest of the electrical enterprises, and who today is happily sharing in the rewards which have come to those who labored thus diligently, is William J. Hammer, the subject of this sketch.

William Joseph Hammer, son of William Alexander and Martha A. (Beck) Hammer was born in Cressona, Schuylkill County, Pa., February 26, 1858. He received his early education in the private and public schools of Newark, N. J., and studied abroad at the University and the Technische Hochschule at Berlin.

In 1878 Mr. Hammer became an assistant of Edward Weston of Newark, N. J., at the works of the Weston Malleable Nickel Company. In 1879 he became an assistant to Thomas A. Edison at his laboratory at Menlo Park, N. J. He was engaged with Mr. Edison on his telephone work, on electric-railway work, and upon practically all of the work then going through the laboratory, but the greater part of his time was devoted to work upon the incandescent electric lamp. In the fall of 1881 he was sent to England by Mr. Edison, and as engineer of the English Edison Company he installed in London the Holborn Viaduct central station. While in London he also installed a large isolated plant, consisting of twelve Edison dynamos, at the Crystal Palace Exhibition. He arranged, for the electrical exhibition held there in 1882, the entire Edison exhibit which had been shown at the Paris Exposition of 1881. In 1883 he accepted the appointment of chief engineer of the German Edison Company. He installed many plants throughout the German Empire, and commenced the building of Edison dynamos at Charlottenburg.

Mr. Hammer returned to America in the fall of 1884, when he took charge of Mr. Edison's personal interests. Later he became confidential assistant to the president of the parent Edison company, and was one of the incorporators and trustees of the Sprague Electric Railway and Motor Company. Shortly thereafter he was appointed chief inspector of central stations of the parent Edison company, and two years later he was made general manager and engineer of the Boston Edison Company. In 1887 he removed to New York to take up special expert work for the parent Edison company, and was sent to St. Augustine to take charge of the 8,000-light plant in the Ponce de Leon Hotel, the largest isolated plant in the world at that time. In 1888 he was appointed consulting electrical engineer to the Cincinnati Centennial Exposition, and as a contractor designed and installed electrical effects as an attraction to the exposition, amounting to upwards of $60,000.



WILLIAM J. HAMMER,
Consulting Engineer.

From Cincinnati Mr. Hammer went to France as the personal representative of Mr. Edison at the Paris Exposition of 1889. During this exposition he accompanied Mr. and Mrs. Edison to the German Science Congress at Heidelberg, and at the close of the exposition he hired an enormous balloon, and accompanied by Drs. Wells and Rotch made a trip of over 100 miles, making meteorological, magnetic, electrical and other observations, and testing original methods of signaling from war balloons.

Since 1890 Mr. Hammer has been independently established in New York as a consulting engineer. He has had occasion to visit abroad frequently on behalf of his clients, and he has on many occasions been a delegate representing the United States and national engineering organizations at foreign universities and scientific congresses and meetings. He has been devoting himself more recently to the development of a number of the many patents which have been issued to him, and has lately devoted a great deal of attention to the study of selenium, and to radio-active and fluorescent substances. He has compiled what is without doubt the most important bibliography on the subject of selenium, and is the possessor of a unique collection of photographs of the leaders in the electrical industry; and his collection of incandescent lamps, which is truly a record of the art, is without an equal anywhere in the world. For this collection of incandescent lamps he was awarded the Elliott Cresson gold medal by the Franklin Institute. Mr. Hammer is a life member of the American Institute of Electrical Engineers, he has been vice-president of both the American Institute and the New York Electrical Society, and was for ten years president of the National Conference of Standard Electrical Rules. He is a member of many other technical societies, and has taken a prominent part in the development of aeronautics in this country and abroad.

He was awarded the John Scott Legacy Medal and premium for his telephone relay and his long-distance sound experiments. He was awarded

a silver medal at the Crystal Palace Electrical Exposition of 1882 and a similar one at the exposition of 1892, the Grand Prize and a special silver medal at the St. Louis Exposition of 1904. He was a member of the committee appointed to organize the International Electrical Congress at St. Louis in 1904, a member of the departmental jury, and chairman of the jury on telegraphy, telephony and wireless at that time. At the Jamestown Exposition International Aeronautic Congress of 1907 he was chairman of the general committee, and during the Hudson-Fulton Celebration of 1909 was chairman and expert for the Aeronautic Committee.

He has contributed many articles to the scientific and popular press and has lectured upon many scientific subjects. His principal published work is a study of radium and other radio-active substances, the first book in the world published upon this subject.

Mine Safety Demonstration.

On October 26 and 27 there will be held at Pittsburg, Pa., a national mine-safety demonstration, under the auspices of the Federal Bureau of Mines, the American Red Cross Society, the Pittsburg Coal Operators' Association and the United Mine Workers of America.

The purpose of the demonstration is to teach methods which will bring about greater safety in mining, and one of the experimental galleries will be given over to an exhibition of electrical installations.

Wireless Men Sentenced.

The higher court has sustained the conviction and sentence of those indicted in connection with the frauds practised by the officers of the United Wireless Company by upholding the lower court's ruling. Christopher C. Wilson was sent to the Atlanta Penitentiary for three years, W. W. Tompkins was sent to Atlanta for two years, and Frank X. Butler will serve one year at Blackwell's Island.

National Association of Cotton Manufacturers.

The semi-annual meeting of the National Association of Cotton Manufacturers will be held at Manchester, Vt., September 27 to 30. Questions of operation, and management of cotton mills will be taken up.

Convention of Pennsylvania Electric Association.

The fourth annual convention of the Pennsylvania Electric Association is to be held at Exposition Park, Conneaut Lake, Pa., September 6, 7 and 8, 1911. The convention will be opened with a reception to President and Mrs. Granger on Tuesday evening, September 5. An attractive program has been arranged, the details of which will be published in a later issue.

As this is one of the largest geographical sections in the National Electric Light Association, a very large attendance is expected, especially in view of the extraordinary registration at the convention held at Glen Summit Springs last year.

Electric Companies Play Baseball.

Rival baseball teams of three lighting companies played a double-header at Oriole Park, Baltimore, on July 29. The White Sox of the Consolidated Gas, Electric Light & Power Company tackled first the crack nine of the Edison Electric Illuminating Company, of Brooklyn. The struggle lasted for twelve innings, and at its close the White Sox sallied forth again to do battle with the fast squad of the United Gas Improvement Company of Philadelphia.

Brooklyn took the first game by a score of 3 to 2, and Baltimore won the second by a score of 3 to 1. Two thousand spectators attended the game.

Manager Lafferty brought the Edison squad from Brooklyn. When Philadelphia was reached, Manager Gallagher and the U. G. I. nine boarded the train. Luncheon was served en route, and at Baltimore the nines were met by the local players and a bus which took them directly to the grounds. A full brass band was on hand during both games and the Baltimore team had as its mascot a diminutive darkey of deep ebony hue who cavorted on a more or less white mule.

Large Merger of Canadian Electrical Properties.

Newspaper dispatches from Toronto, Canada, state that a big electrical merger has been completed by Sir William MacKenzie and R. J. Fleming, who are behind the various deals. When these are all consummated the two men, the one as financier and the other as manager, will be in control of this group of companies: The Toronto Railway Company, the Toronto Power Company, the Electrical Development Company, the Toronto Electric Light Company, the Metropolitan Railway Company, the Toronto & Scarboro Railway Company, the Mimico Electric Railway, and the Toronto & Suburban Railway. In addition to this group the projected Toronto & Eastern Railway is a MacKenzie road, and is to be operated in connection with the Canadian Northern Railway, as is also an electric line from Toronto to Niagara Falls over the right of way of the Electrical Development Company.

It is known that the People's Radial Railway Company, which has been planned to operate through middle western Ontario, may also drop into the MacKenzie syndicate's system. J. R. Fleming has become the manager of the Toronto Electric Light Company. He is already manager of the Electrical Development Company, the Toronto Power Company and the Toronto Railway Company, which controls the Toronto & York Radial.

Electrical Progress at Valencia, Spain.

The American consul at Valencia, Spain, reports that the lighting of the city, when the transformation now in progress is completed, will bear favorable comparison with any of the large cities of the world. Electric power has also been extended to all tramway traffic except in the narrow streets of the older sections of the city where the extionsion of trolley lines is not practicable.

As a direct consequence of the general application of electric energy the demand for gas and steam motors and fixed engines of small and moderate power is declining, and not only are most of the new industrial enterprises operated by electricity but many of the rice hulling and cleaning mills, lumber mills, small household factories, and small structural steel works, which abound, are substituting electricity for every other form of motive power. Where competition is keen among the companies purveying electricity, as happens within the city limits, the price of electric power for industrial purposes has fallen as low as three cents per kilowatt-hour for large consumers, but in outlying townships, with only one source of supply yet available, the cost is from eight to ten cents per kilowatt-hour.

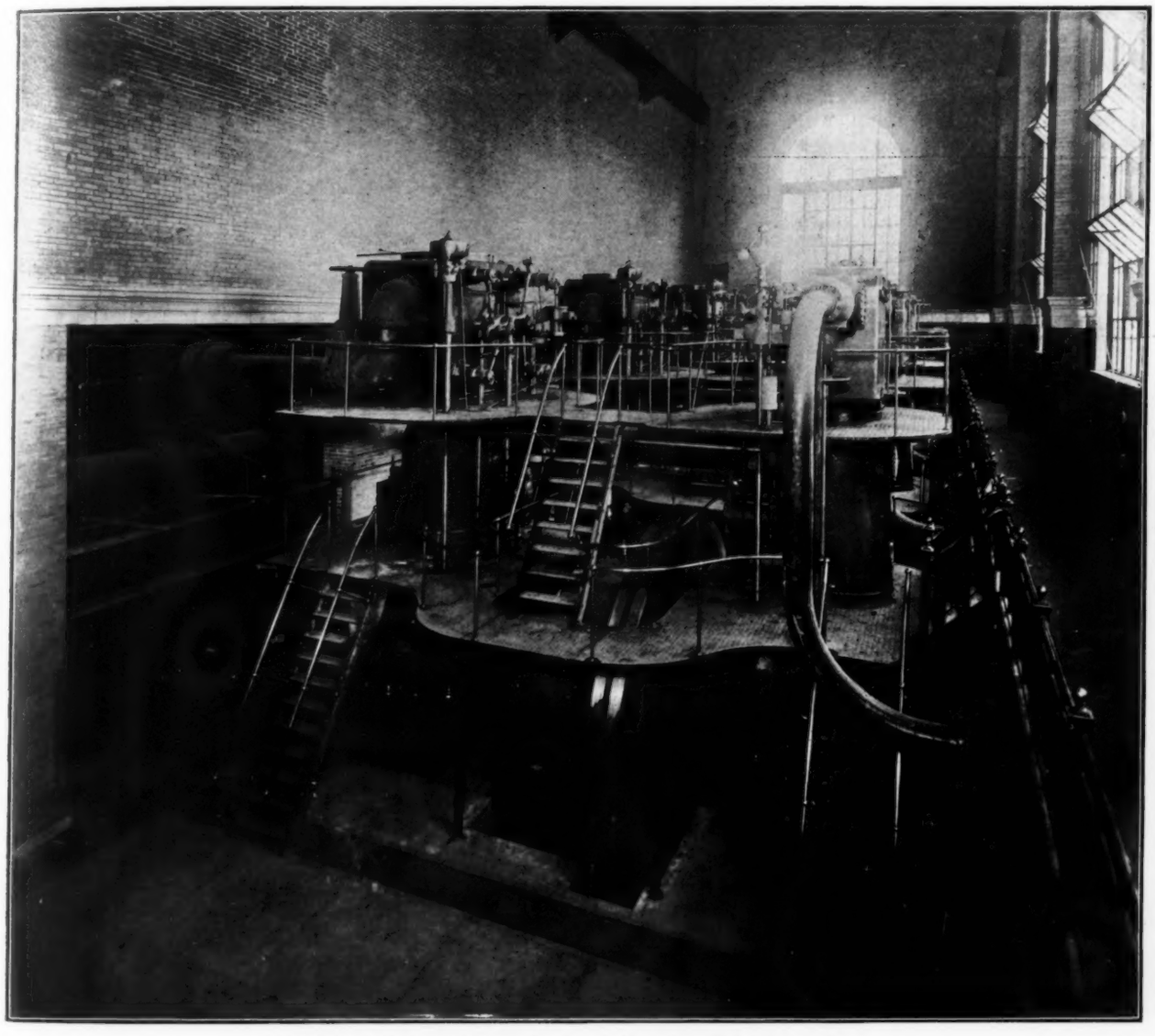
Electrical and Mechanical Features of a Modern Railway Terminal.

The Magnificent New Passenger Station of the Chicago & Northwestern Railway Company in Chicago.

"We have looked ahead fifty years," is the slogan of the builders of the magnificent new terminal, belonging to the Chicago & Northwestern Railway, which has recently been completed in Chicago. Opening on Sunday, June 4, on the eve of a vacation period destined to establish a record in the matter of increased traffic, the terminal has more than adequately met the requirements of an exceptionally busy season and amply justified the remark of the builders. The resources for comfort and business have now been joyfully inspected by thousands of travelers, who can testify to the great advance evidenced in the addition to the country's travel facilities of this great passenger terminal.

The terminal occupies practically four entire city blocks, bounded by Madison Street on the south, Kinzie Street on the north, Clinton Street on the west and Canal Street on the east, passing over Washington and Randolph Streets by means of subways. The approaches alone to this structure embrace some thirty acres of ground, fifteen acres for the north and an equal amount for the west approach. This is entirely separate, and in addition to the old main lines. Between Kinzie Street and Madison Street and Clinton and Canal Streets are some thirteen acres occupied by tracks and station.

The main building is a four-story structure of the early Italian Renaissance style of architecture, with a lofty Doric portico at the Madison Street entrance, supported on a colonnade of six granite columns, each seven feet in diameter at the base and sixty-one feet high. Immediately back of this colonnade, entered by three great arches, is a vaulted vestibule, 132 feet



GENERATING STATION, CHICAGO & NORTHWESTERN TERMINAL.

wide, 22 feet deep and 40 feet high. At each end of this vestibule are broad granite stairways to the main waiting room on the track-level floor. Similar vestibules of simpler architectural treatment give entrance from Canal and Clinton Streets. These vestibules lead directly to a large public space, 200 feet by 92 feet, around which are arranged in the most convenient manner the ticket office, baggage room, lunch room, news stand, telegraph office, parcel check room, etc. From the center of this public space the grand stairway leads to the concourse of the main waiting room on the track floor.

The main waiting room, which is the principal architectural feature of the station, is treated as a great Roman atrium, with a barrel-vault roof. The pilasters and entire order up to the spring of the vault are a dull-finished light-pink Tennessee marble. The columns standing free are of Greek Cippolino marble, whose delicate green hue harmonizes perfectly with the greenish bronze of the metal work framing the glass between the pilasters. The vault is of ornamental-tile construction with richly ornamented ribs of terra cotta, of a color to harmonize with the marble of the walls. Arranged conveniently around this main waiting room are the dining room, women's room, smoking room, barber shop, etc.

On the third floor the architects have planned a series of rooms, including a tea room, bath rooms, lounging rooms and emergency rooms where hospital service is rendered. These rooms are for the use of women only and are reached by separate elevator service. On the other side of the building on this same floor are baths, lounging rooms, private rooms and barber shops for men, also reached by private elevator service.

The baggage room is directly north of the street-level lobby and is exceptionally large and convenient. The baggage is handled to and from the various baggage rooms along the tracks by means of electric trucks and electric elevators.

The exterior walls of the building are of gray Maine granite and are continuous with the inclosing walls of the train shed, which are of mottled gray brick, with granite trimmings. The train-shed walls rise to a height slightly greater than the roof of the train shed, which gives the entire station the external appearance of one mammoth building.

North of the main building the train sheds extend practically to Lake Street. This structure is 840 feet long and extends over three city blocks. The sixteen tracks which occupy the sheds are covered by what is known as the "Bush" roof, in which the curve of the roof over each pair of tracks is broken by a concrete slot or duct running the length of each track and so placed that the locomotive stacks discharge through it into the open air. The roofs are of concrete, covered with water-proofing material. The skylights are wire glass and sufficient in extent to light every part of the train shed.

Between Washington and Randolph Streets are located the suburban concourse, fifty feet wide, mail, baggage and express rooms, carriage and automobile stands and immigrant quarters.

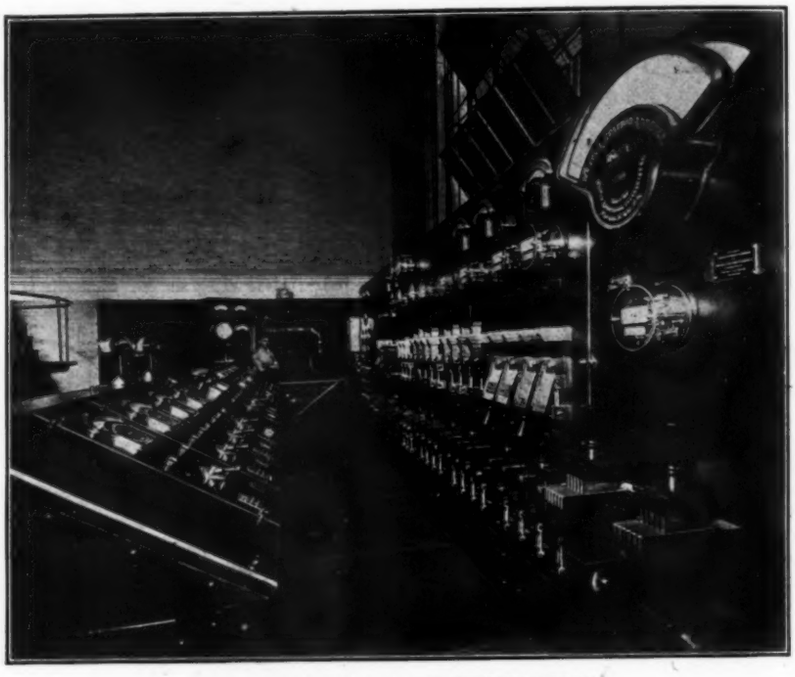
POWER HOUSE

For the electric lighting system in the station building, train shed and various street subways on the approaches, the operation of elevators, ventilating fans, refrigerating systems, signaling and interlocking systems, and the heating plant complete, providing in each case a surplus for future growth, nearly 3,000 horsepower is required. The boilers, engines and generators are housed in the power plant at the extreme northern end of the station. It is equipped with modern appliances and represents in itself an investment of nearly one million dollars.

The power house, occupying a triangular tract of land on Lake Street, Clinton Street and Milwaukee Avenue, has been laid out with special reference to ground conditions and it utilizes an area which would ordinarily be useless. The same attention to detail which characterizes the entire terminal is well in evidence in the power plant.

BOILER ROOM.

The boiler room is situated on the Clinton Street side at the north end, the floor being twenty-one feet below the sidewalk level with the roof seventy-three feet above the floor. The main engine room is on the same side located at the south end. The total width available for the installation of the machinery is forty feet from the lot line to the steel girders of the track elevation.



MAIN SWITCHBOARD AND BENCH BOARD.

The boiler-room equipment comprises six 500-horsepower Babcock & Wilcox wrought-steel vertical-header boilers, arranged in a single row in three batteries of three boilers each. A view of this installation is shown in one of the accompanying illustrations. The setting of the boilers has been specially designed to permit forcing them to heavy overloads. The boilers are set with the Green traveling chain-grate stokers under the mud drum. Each

boiler is equipped with a Foster superheater designed to raise the temperature of the steam seventy degrees Fahrenheit above that due to a pressure of 155 pounds pressure by gauge. Vulcan soot blowers are provided for cleaning out the boilers. In connection with the boiler-feed system there is installed in the power plant two outside, center-packed Epping-Carpenter compound duplex boiler-feed pumps of eight-inch and 12 by 7 by 12-inch size. Also a 3,000-horsepower Webster open-type feed-water heater. There is also provided a Yeoman's electric bilge pump and one Shone ejector for draining the power-house basement.

A complete coal and ash-handling equipment has been installed, so designed as to handle coal in car-load lots. Coal will be delivered to the power station by cars run on a spur track on the track elevation. Below this track are three steel coal hoppers each having a capacity of 300 to 400 tons and being long enough to permit two cars being unloaded at one time. From the bunkers underneath the track the coal passes to a horizontal conveyor, through a coal crusher to a cross steel-belt conveyor, from which it is spouted to a pivoted-bucket conveyor which carries the coal to concrete coal bunkers over the boilers. These bunkers have a capacity of 750 tons. Auxiliary storage capacity of approximately 300 tons is provided under the sidewalk, on the Canal Street side, immediately in front of the boilers.

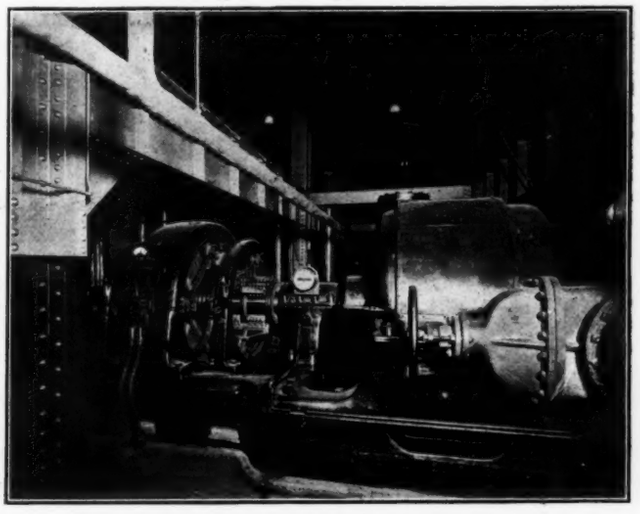
The same conveyor which transports the coal receives the ashes from hoppers located under the boiler-room floor, conveying them to an inclined fan conveyor discharging into an ash bunker located above the spur coal track and capable of holding 100 tons of ashes. The unloading system has a capacity of forty tons an hour.

The breeching and boiler uptakes are of very heavy sheet-steel plate. The breeching, covered with two inches of vitrobestos, extends over the top of the boilers at the rear and beneath the coal bankers, and at the north end enters the reinforced-concrete breeching, which is extended to the base of the stack.

The stack for the power house is built of "Custodis" radial brick. It rises 225 feet above the sidewalk and is approximately 245 feet above the grates. The inside diameter at the base is eleven feet and at the top ten feet six inches. The chimney rests on three caissons carried down to rock. It is surmounted by a very heavy cast-iron cap, and is protected with four lightning rod points, each having a twenty-four-inch platinum tip. The points are connected to rods which in turn are fastened to a copper cable surrounding the top. Connecting with this ring and at the places where the point rods are connected to the ring, cables are carried on either side in a "Y" shape until connection is made with the main lightning conductor, one being carried down each side of the chimney. These cables are of 256,000 circular mils cross-section, and are tinned to prevent any possiblity of corrosion. The entire lightning protection was installed by Carl Bajohr.

The steam piping system has been designed along standard lines. However, unusual precaution has been taken to guard against breakdown. Steam from the boilers passes through six-inch stop and check valves to the main header which graduates in size from eight-inch diameter to ten inch and finally twelve inches. This header forms a loop in the engine room with a ten-inch auxiliary header, so that steam can be supplied in either direction from the boilers. Superheated steam is used in all of the main and auxiliary piping. From the main thirty-inch exhaust header, extending along one side of the engine room, is run a sixteen-inch connection to the exhaust-steam turbine. A connection from the auxiliary header is also run to this turbine, this making it possible to run the unit and still shut down the entire system of main headers, for cleaning or making repairs.

BOILER ROOM.



EXHAUST-STEAM TURBO-GENERATOR.

ENGINE ROOM.

The engine-room floor is slightly over ten feet below the sidewalk level; the crane rails are 47 feet 8 inches above the engine room floor while the roof, due to its pitch, varies between 60 and 63 feet, this giving a very high and exceedingly well proportioned room for a plant of this character.

In the engine room there are at present installed three vertical cross-compound non-condensing Allis-Chalmers Corliss engines, rated at 1,200 indicated horsepower under guaranteed steam consumption of nineteen pounds per indicated horsepower-hour with steam pressure at 155 pounds, and seventy degrees Fahrenheit, superheat. As will be seen in the illustration of the en-

gine room, the engine platforms are all intercommunicating and arranged for convenience of the operators. Each engine is direct connected to a 750-kilowatt 250-volt direct-current compound-wound General Electric generator running at 100 revolutions per minute. Space has been left for an additional engine and generator of the same size as above.

Adjoining the generating room on the east is the machinery room. One of the features which makes the power plant particularly interesting is the fact that there has been provided a Curtis low-pressure steam turbine direct connected to a 500-kilowatt 250-volt direct-current generator, running at 1,500 revolutions per minute. This unit is installed in the machinery room with space left for an additional one. The latter has been installed under a guarantee to deliver a kilowatt-hour on 43.5 pounds of exhaust steam, or a horsepower-hour on 32.7 pounds. Using the 21,400 pounds of steam exhausted from the engine unit, the low-pressure machine will develop an additional 786 horsepower, making a total of 1,936 horsepower for the combined outfit, on 21,400 pounds of steam, or a horsepower-hour on 11.8 pounds of steam. The generator of the steam-turbine unit will be operated in multiple with the engine-driven generators.

In connection with the turbine there has been provided a Worthington surface condenser with 4,000 square feet of cooling surface, guaranteed to maintain a vacuum within three inches of absolute when condensing 23,000 pounds of steam per hour, with circulating water at seventy-five degrees Fahrenheit. On the roof of the plant, above the boiler room, there is located a cooling tower of the four-fan type, the fans being driven by two twenty-five-horsepower motors. This tower will cool the necessary amount of condensing water and in addition all jacket water from the engines, air-compressors, etc., collected in a tank, is pumped to the cooling tower.

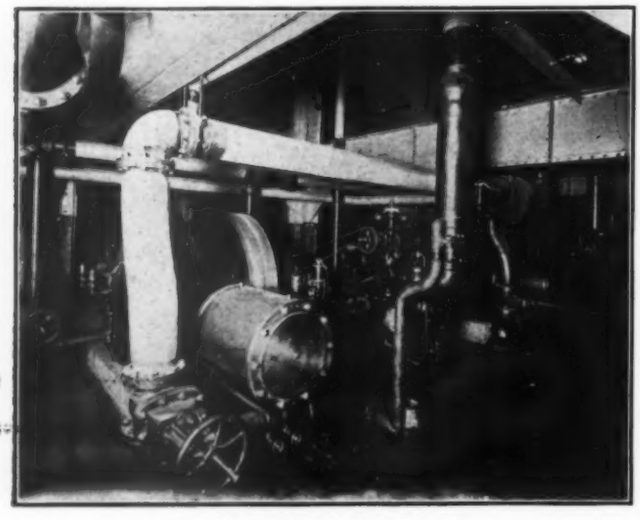
In the machinery room, south of the turbine set, there are installed two 500-kilowatt motor-generator sets which are used for furnishing alternating current for lighting service along the Northwestern line, inside the city limits; also for subway lighting, switching and for the signal system. Each set comprises a direct-current motor driving a 500-kilowatt, 6,600-volt alternating-current three-phase, sixty-cycle generator, each with its own direct-connected exciter unit.

Other machinery in the plant includes one three-wire balancer set, of a capacity to care for 300 amperes unbalanced load; two air compressors, comprising two imperial-type Ingersoll-Rand, two-stage machines, with cross-compound steam ends, each of a capacity to compress 500 cubic feet of air per minute to 100-pounds pressure. A gravity oiling system is provided for the plant which supplies oil to all machinery. A twenty-five-ton, three-motor traveling crane spans the engine room.

SWITCHBOARD AND WIRING.

The main switchboard, as shown in one of the illustrations, is located on a gallery at the south end of the building and is equipped with bench board for the electrical control of all main-line switching devices, electrically operated motor starters and speed regulators, and electrically operated field rheostats, also with momentary-contact switches for operating automatic solenoid switches controlling station lighting. The board is also equipped with all regulating and controlling devices for the circuits leading to the station building.

Due to the fact that the terminal property is practically divided into four sections by Washington Street, Randolph Street and Lake Street crossing between Madison Street at the south and Milwaukee Avenue at the north end, it was practically necessary, in a measure, to divide the electrical distribution; this was accomplished in



AIR COMPRESSORS.

BOILER-FEED PUMPS.

This low-pressure turbine will be used only at such times as exhaust steam would ordinarily be allowed to waste to the atmosphere, it being planned to run noncondensing during seasons when steam for heating will be necessary. When not running on the heating system the light loads will be taken care of by one of the Corliss engines, and as the load increases beyond the capacity of one engine unit the low-pressure turbine will be cut in and as the load increases another Corliss engine, and so on until the plant is fully loaded.

The engine sets are guaranteed to run on 18.6 pounds of steam per indicated horsepower at full load, against 16.5 pounds absolute back pressure. This will mean 21,400 pounds of steam exhausted to the low-pressure turbine.

the following manner: Starting with the power house, back of the bench-board on the switchboard gallery is placed the main-feeder board from which all feeder lines are run. These comprise feeders to the main building for light and power service, and feeders to the switchboard located in machinery room just south of Randolph Street in the undertrack.

For furnishing power and light to the main terminal building there have been run twelve 2,000,000-circular-mil cables, these being rubber covered from the switchboard to the runway immediately above the train sheds on the Clinton Street side. Where these cables enter the runway they are weatherproof triple braid and threaded through holes in the roof girders, resting on asbestos wood blocks, porcelain bushings being provided in each case. In addition two supports are provided between each of these girders, as the distance of twenty-six feet is considered somewhat long to support the wires rigidly as desired. To hold these transmission cables taut there has been provided at the north and south end of the cableway special arrangement made as follows:

An asbestos board two inches in thickness with three-inch holes drilled to register with the holes in the girder is placed against the steel work and after the cable is pulled up the insulation is stripped and a standard two-inch shaft coupling clamped to the cable, thus firmly securing these cables and permitting a minimum amount of sag between supports. These couplings, after being placed, were thoroughly taped. At the south end of the cableway rubber-covered cables are attached, these passing through conduits to a distributing switchboard located in what is known as the switchboard room in the basement of the station building. Four of these cables are connected through double-pole switches to the main lighting busses; two of them are connected directly through double-pole switches with power busses; two are connected through double-pole switches to the train-lighting busses.

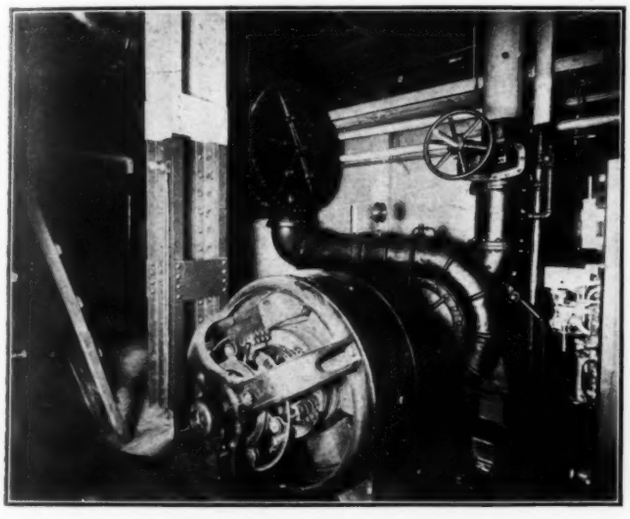
In each case the two positive and two negative cables are each connected separately to a special plate forming part of a switch made up with two separate blades, each with its own handle. The arrangement is such as to permit in one case of one set being thrown either to the lighting busses or on the train-lighting busses while the other connection is made to either the power or to the lighting busses.

Special switching arrangements have been provided for obtaining feeder regulation. During the daytime and up to such time as the ledge lights are not required the feeder cable is disconnected from the board and at the same time separate feeder switches provided for the ledges are opened. One set of feeders cares for practically 110 to 135 kilowatts. In operation the result is that when the lighting is on the building, two sets of feeders are in service for lights and two for power, another set being thrown in when the train lighting is required and still another set when the ledge lighting is required. Results show that there is but variation between 0.3 and 8.8 volts between no load and full load. These variations would naturally be dependent upon the load and the cables that may be in service.

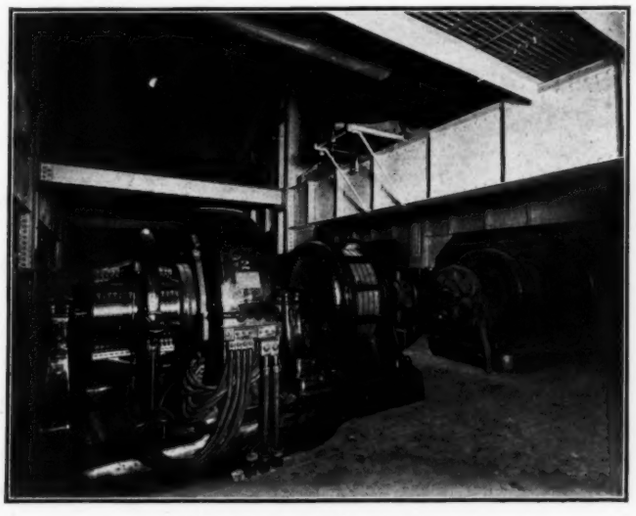
The light and power service in the blocks between Washington Street and Lake Street is controlled from the board in the undertrack machinery room above referred to. A balancer set is placed in this machinery room of capacity to care for 300 amperes unbalanced load. A duplicate of this balancer is placed in the power house, as mentioned before, and the two are interconnected by suitably arranged switches so as to permit of one acting as a relay to the other. Light and power service for the power house is furnished directly from the main feeder board.

In the power station, the remote-control feature in connection with the alternating-current apparatus is substantially that in general use for 6,600-volt work. In connection with the direct-current apparatus, the control has been somewhat elaborated on, due to the special conditions existing in the plant, such as the motor-generator sets being operated from the direct-current end and the operation of the circuit-breakers which are used as line switches connecting the direct-current dynamos and the turbo-generator with the system of busses.

The remote-control circuit-breakers for the 750-kilowatt direct-current generators have a nominal rating of 4,000 amperes. These are installed in recesses in the engine foundations leading off from the tunnel running north and south along the west side of the



MOTOR-DRIVEN CIRCULATING PUMP.



MOTOR-GENERATOR SETS.

power house below the engine-room floor. By the use of these appliances placed in this manner there is secured economy of space not otherwise available, at the same time simplifying the switchboard and increasing the flexibility of the system. Thus the switching apparatus for each individual unit in the power house is placed in close proximity to its unit. The remote-control switches are placed on the bench board on the platform as already described and from these are controlled all of the various circuit-breakers of the direct-current dynamos and those installed in connection with the motors of the motor-generator sets. In addition, the oil switches for the 6,600-volt motor-generator sets as well as oil switches for the feeder circuits leading north from the power house are operated.

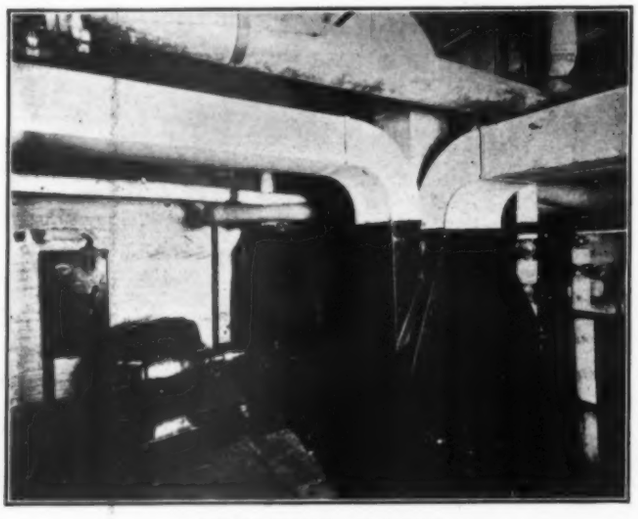
The 4,000-ampere circuit-breakers for the three engine-driven units and the 3,000-ampere circuit-breaker on the exhaust-steam turbo-generator are three-pole, 250-volt, two-coil overload, motor-operated, remote-control "I. T. E." breakers. These are electrically and mechanically interlocking. In operation they close without the least shock or jar, as instantly upon the start of the closing movement, the control switch is automatically short-circuited by the closing mechanism and the movement thus completed without further action on the part of the operator.

The circuit-breakers used in connection with the motors for driving the alternating-current generators are of the same general type, but are single pole, two being installed with each motor. By closing the control switch on the bench board, one of these single-pole breakers is closed, thus permitting current to pass through the contactors closing one after the other of the automatic motor starters, the closing of the last contactor automatically closing the short-circuiting motor-operated switch or circuit-breaker.

Resistances have been placed in series with the field of each of the motors of these motor-generator sets, so as to permit of synchronizing, the bench-board being equipped with all synchronizing devices.

All of the generators with the exception of the exciter are equipped with electrically operated rheostats, each being controlled from its generator panel on the bench board by means of push-button switches.

The exciters for the alternating-current machines are connected directly to the busses without any circuit-breakers or fuses, remote-control switches on the benchboard bringing contactors into operation which connect the exciters to the busses. As each exciter is directly connected to the shaft of its motor-generator set, it was necessary to devise some arrangement whereby an accidental manipulation of the remote-control switch on one of the dead exciters in case only one machine was running was impossible, to prevent a short-circuit when throwing the dead exciter on to the busses as a motor. This is accomplished by placing in one of the legs of each of the exciters a reverse-current relay, which acts upon reversal of current and closes the circuits through an auxiliary relay placed on the benchboard, this relay opening the circuit through the closing coil of the contactor, which connects the exciter to the exciter busses and at the same time closes the circuit to a bell, thus indicating to the operator that the dead exciter has been thrown on to the bus-bars. This installation called for some special arrangement in connection with the opening of the field circuit of the alternating-current machines. Inasmuch as everything is remote-control, it was not possible to use the ordinary field switch. The arrangement worked out for this consisted of placing a connection on the extended shaft of the remote-control switch, this being in the form of a triangular contact which would enter blades when the switch was opened, these blades closing the circuit through the closing coil of a small contactor which connects the discharge resistance across the fields.



MOTOR-DRIVEN BLOWER.

ELEVATOR PUMPS.

The high-tension oil switches for the service north of the power house are placed in a separate room. The switches are General Electric, three-pole, 300-ampere, 15,000-volt oil switches, and are equipped with the regulation closing solenoids and in addition they are fitted with tripping devices adjusted to automatically open the switch on a predetermined overload or "short" on the outside lines or from the control switch on the feeder panel of the distributing board when it is desired to open the circuit.

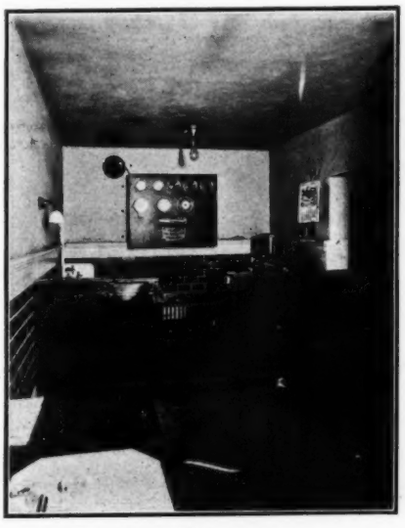
In the undertrack portion there is provided a remote-control 500-ampere, two-pole switch for connecting the feeder lines to the mains in the block between Randolph Street and Washing-

ton Street. This is operated automatically, a knife switch being closed to start the balancer set, which, when up to speed, closes a contactor which connects the neutral of the balancer set to the neutral busbar, this in turn closing the second neutral contactor, connecting the neutral main of the three-wire system to the neutral bus at the switchboard. When this latter contactor closes, connections are made so as to energize coils on the 500-ampere remote-control switch, connecting the two outside legs of the system. It will thus be seen that it is impossible to close the outside legs of the three-wire system until the balancer set is brought up to speed and ready to take its load when the contactor in the neutral main is closed.

HEATING AND VENTILATION.

The heating system in the main building so far as the direct radiation is concerned is extremely simple, what is known as the "Overhead" system being provided; while the blast coils located in the basement of the building are fed directly from the central distributing header.

A very small amount of direct radiation has been installed in the building, this being placed mainly in the offices on the third floor; in the lunch room and baggage room, first floor; and in the women's room, dining room and annex to main waiting room on the track-level floor. In addition radiation has been placed just inside of the Madison Street vestibule entrance as well as that on Canal Street, the particular object in this being to care for such cold air as will tend to rush into the rooms when the outside vestibule doors are opened as the public pass to and fro. Likewise radiation has been placed in the main concourse next to the gates leading to the train sheds so as to temper this cold air as much as possible, and



ENGINEER'S OFFICE.

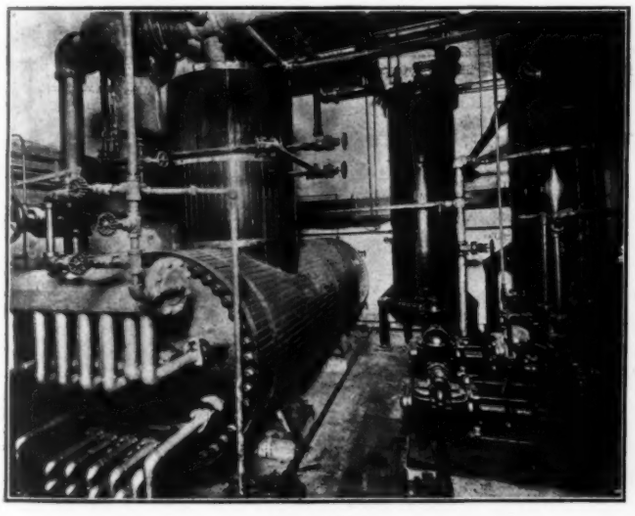
for similar purposes radiation has been placed near the east and west entrances of the suburban concourse in the under-track portion north of Washington Street.

The entire heating system throughout is that known as the vacuum system, this permitting of utilizing all of the exhaust steam from the engines and other steam-actuated apparatus that may be necessary for heating purposes. The surplus is used in the exhaust-steam turbine, a description of which is given under sub-heading "Power House." The valves in connection with the direct radiation throughout the building which are attached to the vacuum system, were furnished by the Consolidated Engineering Company. Marsh vacuum pumps are installed in the sub-basement and these deliver the condensation into a common receiving tank provided with special float valve governing the operation of return pump, which delivers the returns back to the feed-water heater in the power house.

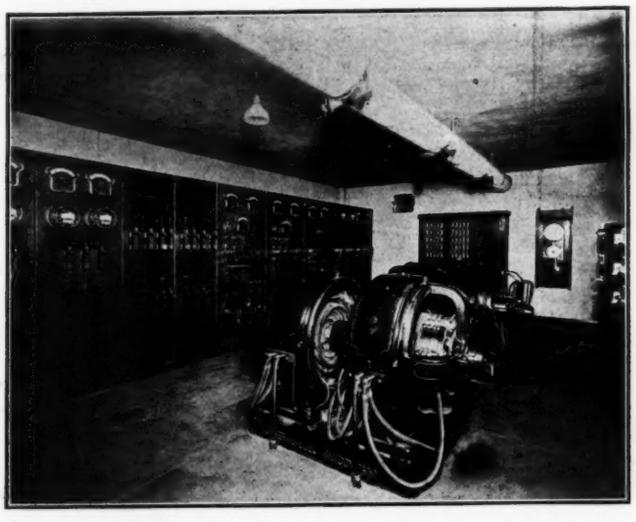
Two fourteen-inch pipes are installed for transmitting exhaust from the power house to the main building, these pipes being carried together with a five-inch high-pressure one for the elevator-pump supply in a runway above the train shed on the Clinton Street side. For the undertrack portion two ten-inch pipes are run, one to care for the Post Office, the other for all of the other undertrack portions.

The Post Office is equipped with its own separate heating and ventilating plant which can be operated independently of any other plant.

In the undertrack portion the steam supply pipes are all carried through or suspended from the track structure. Branches drop down to radiation with returns below the floor lines. In the suburban concourse and the emigrants' quarters tunnels are provided in which the pipes are run. This arrangement is necessary to permit of radiation setting in the middle of the room. The tunnel in the suburban concourse is designed with entrance doors and partitions so as to be used as an air duct for supplying ventilation to the Post Office as well as for running steam mains.



ICE PLANT.



BALANCER SETS AND SWITCHBOARD IN UNDERTRACK PLANT.

The terminal property being divided by the east and west streets into practically four sections it was necessary to treat each block as a separate building so far as the return end of the heating system was concerned as there were conditions which prevented an underground connecting tunnel. Each block therefore has its own duplicate set of vacuum pumps. These, however, delivering into a common return running back to the power house excepting that an independent return is run from the main building.

The exhaust from engines and other steam-actuated apparatus in the power house is utilized for heating purposes and is supplemented at the station building by exhausts from elevator pumping machinery and the pumps used in connection with the heating system. During the summer months the exhaust from the elevator pumps is utilized for the heating of water for kitchen, toilet, etc., thus allowing the service mains from power house to be cut out. In operation it has been found that it is possible to utilize the excess supply of exhaust from the elevator pumping machinery during the summer time by opening the valves in one of the fourteen-inch mains connecting with the power house, the steam passing back through this and being used in the exhaust-steam turbine, this pipe acting as a regenerator. The installation is peculiarly unique in this respect inasmuch as it is extremely economical and no item seems to have been overlooked, not only in the original inception but in the plant as finally completed.

The ventilating system is one of the most complete of its kind yet installed. Both the Madison Street and Canal Street vestibules have their separate fan systems, the one in Madison Street being divided into two separate units, one at the east and one at the west end, each taking its air through stair risers, drawing it over tempering coils, thence through washers, the fan delivering it over re-heating surface through large solid bronze register faces. The only difference in the Canal Street vestibule is that the air is drawn through register faces at each end and blown out again through corresponding register faces. The object of taking the air out of the vestibules and blowing it in again is that the natural tendency is for cold air to rush into the vestibule as the doors are opened, the intake of the fans catching this before it can reach the doors leading into the main public space, and delivering it as washed heated air back again to the vestibule. The incoming air is fresh although it may be dirty, but as the washers take care of this, the vestibules are sure of a fresh, clean supply of air continuously. The effect is, especially in summer time when the air is not heated, that the traveler passing from the hot streets enters these vestibules with a remarkable sense of relief as these vestibules have been delightfully cool during the past specially hot weather. In winter the effect will be to enter a warm atmosphere immediately upon passing through the outer doors.

Ventilation has been provided for the dining room and the women's room as well as other rooms of a similar nature, but the main heating is done by direct radiation. In the public space on the first floor and the main waiting room on the track-level floor, the entire heating and ventilation is accomplished by a fan system, although there are a number of radiators placed on the ledges in the main waiting room underneath the large windows so as to prevent downward currents of cold air. The main ventilating plant for the building is located in the basement underneath the Madison Street front. Fresh air is brought into a large chamber through two vertical shafts extending to the top

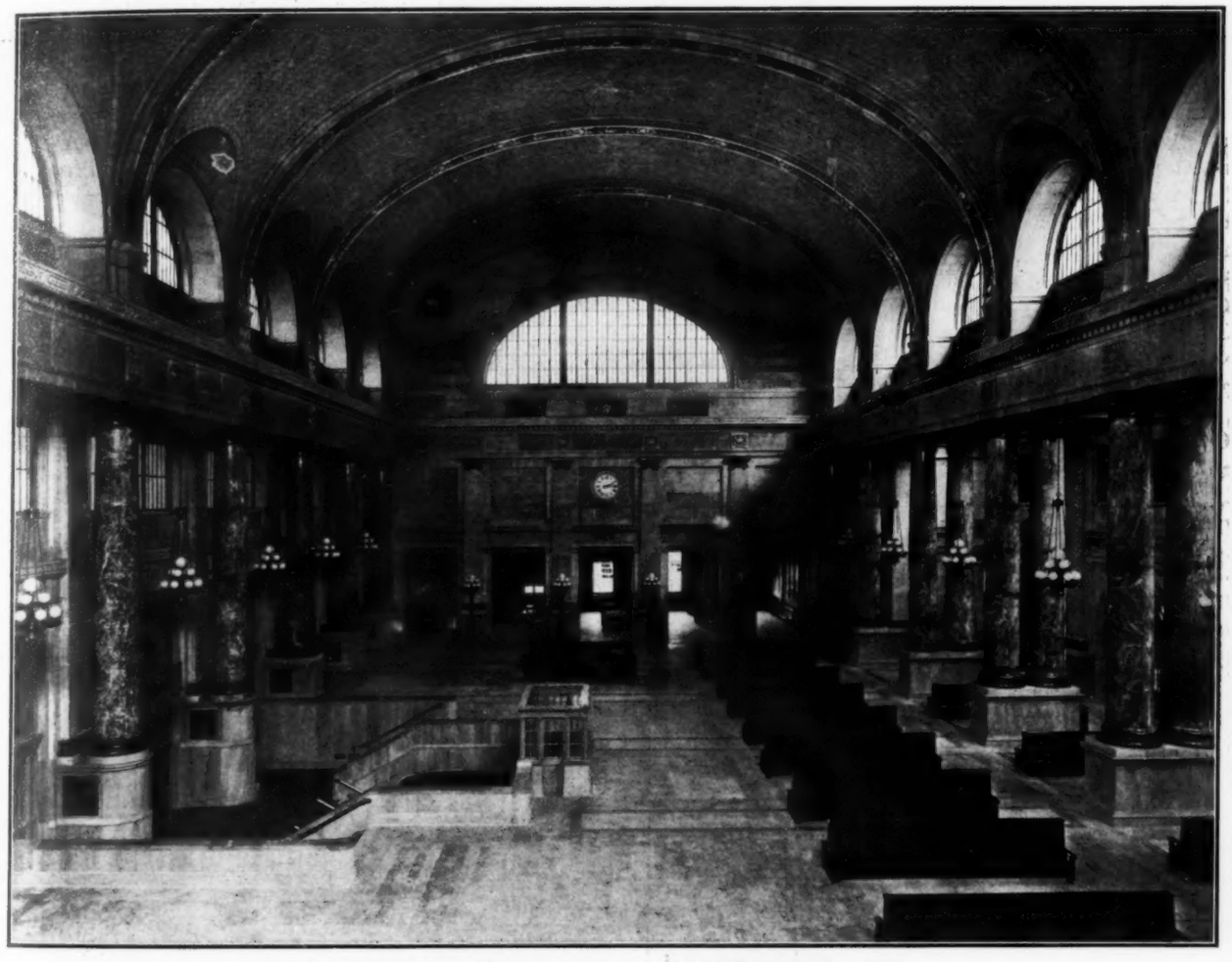
NIGHT VIEW OF EXTERIOR LIGHTING.

GENERAL VIEW OF TERMINAL BUILDING.

of the building, with intakes at the back or north side of the clock towers. There are three systems, one caring for the east side, one for the west side of the building, while the center plant takes care of the public space and the main waiting room. The fans are all Sirocco design and driven by Sprague motors. Each fan delivers into a duct below the basement floor level, these being connected to chambers from which are led smaller ducts to the various rooms to be ventilated. The underground ducts have a horizontal partition dividing the heated air from the tempered air and these are brought into the chambers in the usual manner. The air as delivered into the ducts leading to the rooms is controlled by mixing dampers operated by air motor valves controlled from thermostats placed in various portions of the building. These in most cases are connected to multiple-point accumulators in such a manner that should one portion of the room become heated before the other, the dampers will not operate until the second or even the third thermostat acts.

The washers are designed so as to use the water over and over again, there being only sufficient amount of overflow to carry away the oil and lighter floating particles. Motor-driven centrifugal pumps take the water out of one compartment, which is separate from the main washer excepting by a connection below the water level, and deliver the water for the washer into a pan above. The bottom of this pan is perforated and the water falls in a continuous rain.

The entire heating and ventilating system is designed to maintain a maximum temperature of seventy-two degrees Fahrenheit in all of the rooms either heated or ventilated, with an outside temperature of ten degrees Fahrenheit, below zero. The system of control is that of the Johnson Service Company, being so connected as to operate not only the radiators, and the mixing dampers of the ventilating system but to control the temperature of the hot water used throughout the building and for kitchen purposes. In connection with this system an arrangement has been installed whereby all of the dampers in the attic-discharge fans, while normally being held closed, can be opened either from the engineer's office in the basement or at each fan plant. A little marble board with lever valves has been installed in each place to permit of this control. An arrangement of this kind is also installed in each of the attic-fan plants.



MAIN WAITING ROOM, CHICAGO & NORTHWESTERN TERMINAL.

LIGHTING.

The terminal station building proper is lighted throughout with tungsten lamps. These, with a few exceptions, are 150 and 250-watt units. In small rooms and stairways, telephone booths, etc., the lamps are forty-watt or sixty-watt dependent upon the space to be lighted.

The public space on the ground-floor level and the main waiting room on the track-level floor are said to be two of the most brilliantly lighted rooms in any railway terminal or public institution in the world. The fixtures in the public space are extremely simple, consisting of a ring or crown holding eighteen-inch-diameter white opal globes, one being placed in the ceiling of each bay and containing four 100-watt lamps. These lamps are arranged on two circuits so that when occasion does not require all of the lamps to burn, fifty per cent of the lighting can be cut out, the system being further divided so that various sections of the room can be turned on or off.

The main waiting room is to a very great extent illuminated by indirect lighting, these lights being placed on the ledges running along the north and south sides of the room at an elevation of forty-six feet above the floor. The ledges are ten feet wide. Each ledge is divided into seven spaces by the arches supporting the barrel roof and in each of these sections there are thirty 250-watt lamps, each with an Alba reflector set at the proper angle to obtain the greatest amount of reflected light from the ceiling. Lamps and globes are mounted on a special frame designed for this particular purpose, the frame being adjusted so as to vary the angle at which the light strikes the ceiling, which at its highest position is eighty-four feet above the floor line. There is a total on both ledges of 420 lamps, this being the equivalent of over 70,000 candlepower.

Supplementing the indirect lighting, fixtures hang from the soffits between the columns of both the north and south sides and in addition to this, the east and west ends of the room are furnished with four magnficent standards. The standards contain about 1,880 candlepower, each made up of lamps varying in size from 100-watt to 150-watt. The indirect lighting is so arranged as to give a soft even distribution of light over the entire ceiling, this ceiling being made of guastavino tile, buff in color.

LIGHTING UNITS IN TEA ROOM.

With but few exceptions throughout the building, the lighting is direct. Special treatment, however, has been given to the dining room, the women's waiting room and the women's tea room, where indirect or reflected lighting is used, this giving a soft evenly distributed light throughout but naturally of less intensity than were direct lighting used.

The barber shop on the track-level floor has been provided with indirect lights, while direct lighting has been placed in front of the mirrors, as well as bracket lights along the wall, the arrangement being such as to keep the direct rays out of the line of vision of anyone in the barber chairs.

Throughout where direct lighting is used, Alba globes or Alba deep-bowl pattern shades are used with but few exceptions, such as in the corridors in the office portions of the building where the diffusing Alba shade is installed.

In connection with the lighting, there is one point that deserves particular comment and that is the special fixtures designed and installed for throwing light directly on to the stair landings. Since the station has been opened, it is found that this lighting is quite sufficient, without the use of bracket lights, to illuminate all of the minor stair cases throughout the building, not only throwing enough light upon the landing but sufficient being cast upon the walls to perfectly light the stairway.

Special fixtures were designed by the engineers for lighting the basement, the baggage storage room under the main concourse and the incoming baggage room on the ground-level floor. These are made up with a specially designed shock absorber, plain conduit stem with spun-zinc canopy and cast-zinc weatherproof socket, each being equiped with a large 250-watt Alba shade. A single unit is placed in each bay as near as

TYPE OF FLOOR STANDARDS USED IN STATION.

LIGHTING UNITS IN LADIES' REST ROOM.

the steel construction would permit and it is particularly interesting to note that this arrangement has been so nicely worked out as to give an even distribution of light over the entire floor space in all instances.

One feature of special note in connection with the lighting is that in all large spaces, the circuits are operated by remote-control switches, brought into action by momentary-contact push-button switches located in the information bureaus, one being on the first floor, public space and the other in the main waiting room, track-level floor. From these points lighting is controlled throughout the main public space, the street lamps, the main waiting room, main concourse and the end of the train sheds between the concourse and the track bumpers. The main waiting room lights are controlled in sections, circuits being so divided as to permit partial lighting at such times as the entire illumination is not required; for instance each ledge is divided into two sections, each section being controlled by two push-button switches. This allows of but one-half the ledge lights to be turned on or all of them, as desired; likewise the hanging fixtures and the standards, the fixtures being so arranged that the switches will throw on only the upper lights or the lower row of lights as desired. This same applies to the main-concourse ceiling fixtures.

INDIRECT LIGHTING IN MAIN DINING ROOM.

The undertrack portion is lighted throughout in the same manner as the basement of the terminal station, 250-watt lamps being used throughout with the exception of such places as carriage driveways and automobile space where 100-watt lamps are used. Likewise the subways are equipped with the same class of fixtures and with 100-watt lamps and shades. These subway fixtures are also further provided with guards which were made specially for this installation. The guard is so designed as to cover the entire shade, being hinged at the top and fastened at the bottom with a small "Yale" lock clamping two heavy No. 12 wire rings. These guards serve the double purpose of preventing lamps from being stolen and avoiding breakage of lamps and shades by teamsters' whips. The same protection has been provided for lamps and shades in undertrack and public spaces, such as driveways and in express, baggage and mail rooms.

Special attention has been given to street lighting, the architects having designed special posts or standards, those on the Madison Street front of the building being quite ornamental in design, while those for sidewalk lighting on Canal and Clinton Street and Milwaukee Avenue are of a more simple design but quite artistic. The four large standards in front of the Terminal each contain thirteen lights, three 150-watt lamps being placed in the top thirty-inch globe and 100-watt lamps in the others, the two lower

globes each containing three sixty-watt lamps, making a total of 1,210 watts. The other street posts are equipped with three sixty-watt lamps in a twenty-inch Alba globe for the top, while each of the three brackets from which the twelve-inch lamp globes hang contains one sixty-watt lamp, making a total of 360 watts per post. In all there are fifty-three street lamp posts in addition to the four large standards.

Special lighting provision has been made in the post office, the driveway being illuminated by some thirty-five Cooper-Hewitt mercury-vapor lamps. In the post office proper the general illumination is carried out in the same manner as all other undertrack portions, but in addition there has been provided over the sorting cases small twelve-volt tungsten lamps placed nine in series.

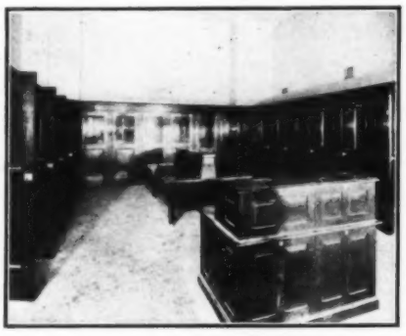
MOTOR APPLICATIONS AND MISCELLANEOUS.

The railway company has installed four mail conveyors, these coming between the tracks and so arranged as to permit of readily unloading mail from the cars, dropping it into these conveyors at any point where the car to be unloaded may stand. The mail sacks are delivered to the post office station "U" occupying undertrack portion between Washington Street and the suburban concourse.

As the kitchen is located in the basement with the serving room for the lunch counter of the ground floor; the serving room for the dining room on the track-level floor, and the serving room for the women's tea room in the third floor, it was necessary to devise some quick means of transportation between the kitchen and these various serving rooms. For this purpose three electrically controlled dumb waiters were provided and in addition to the customary control-button system, a buzzer system has been added which greatly facilitates their operation.

Each of the serving rooms above mentioned is equipped with a refrigerator box which is cooled by brine circulation from the plant in the sub-basement of the building.

The refrigerating system was installed by the Carbondale Machine Company and is one of its fifty-ton absorption plants. The plant is placed in the sub-basement of the terminal station building and cools drinking water for the entire terminal, including the power house. The system of piping is divided, one pump caring for the station building and the other for the undertrack portion, including the power house. The system also cares for all of the cooling rooms and refrigerator boxes used in the kitchen of restaurant and those installed in the serving rooms and in addition a large box for the drug



MAIN TELEPHONE ROOM.

store. City water is used for drinking purposes, but it is thoroughly filtered through porcelain lined "Manning" filters, every precaution being taken to give pure filtered water to the public. A scheme originating with the consulting engineers and adopted by them in several of their installations has been used here for the cooling of the milk

DETAIL OF INDIRECT LIGHTING IN MAIN WAITING ROOM.

in serving rooms and lunch counter, refrigerated water being circulated between the outer and inner shell of the milk coolers, this keeping the milk at the same temperature as the drinking water. This renders the use of ice unnecessary and it is vastly more convenient than to keep the milk in the refrigerator boxes.

As the refrigerating system uses ammonia, the room in which the apparatus is installed is designed with the idea of being able to entirely close it off and a separate ventilating plant has been installed which will entirely clear the room in three minutes. Doors have been arranged at opposite corners of the room so as to afford ready egress to anyone working in the plant should a rupture occur. All precautions have been taken for the protection of the men operating this system, although no accidents with a system of this kind have ever occurred in the experience of the designing engineers.

On account of the east and west streets dividing the terminal, all incoming baggage is delivered on the ground-floor level in the baggage room under the main concourse, while the outgoing baggage is delivered to the baggage room in the undertrack portion between Randolph and Lake Streets. Due to this it was necessary that some quick means of communication be established between the two baggage rooms. This was accomplished by installing a pneumatic-tube system with terminal in the baggage check room in the main station building and other terminal at the outgoing baggage room. Special cartridges were used, these being 3 by 6 inches, elliptical cross section, approximately twelve inches long. The blowers are installed in duplicate and driven by Sprague motors, this power plant being placed in the basement of the terminal station building. The system was installed by the Lamson Consolidated Store Service Company.

Two complete installations for vacuum cleaning have been made, each of eight-sweeper capacity under continuous service. One system is installed in the machinery room in the terminal station basement to care for the main building, while the other system is installed in the machinery room, undertrack portion just south of Randolph Street. This cares for all of the undertrack space between Randolph Street and Washington Street, with separate connections leading to the post office. This apparatus was furnished and installed by the Vacuum Engineering Company.

An intercommunicating telephone system has been installed throughout, as manufactured by the Couch Company, connecting all of the operating departments from the terminal station to the power house, including the undertrack portion.

A complete McFell fire-alarm and

watchman's clock system has been provided with fire-alarm boxes located at convenient stations throughout between Madison Street and Milwaukee Avenue. Storage batteries for the operation of this system are installed in a room immediately off from the general machinery room in the basement of the terinal building. This equipment consists (besides the various stations from which an alarm can be turned in) of register tapes and gongs, together with watchman's clock which indicates the station and the time at which it was punched. In connection with this fire-alarm system a city fire-alarm box has been installed adjacent to the switchboard which permits of an alarm being turned in to the city after it is registered in the switchboard room, thus placing the city fire alarm in direct connection with the terminal station.

For issuing orders in connection with the operation of trains, a telautograph system has been installed in connection with which there is provided a telephone system. The telautograph stations are placed in various localities around the terminal and orders written at any point are reproduced at other stations on the traveling roll of paper.

The dining room has been equipped with a telautograph service of its own, so arranged that orders written in the dining room are reproduced in the kitchen, this method saving a very considerable time in the transmission of orders.

The electrical and mechanical work for this complete plant was designed by and erected under the supervision of Pierce, Richardson & Neiler, consulting engineers, Chicago. F. J. Ravlin, chief engineer of power stations for the Chicago & Northwestern Railway, is in direct charge of operation of the plant.

Turbine Tests at the Riverside & Dan River Cotton Mills.

Recently tests were made on the 1,500 and 3,500-kilowatt steam turbines in operation at the power station of the Riverside & Dan River Cotton Mills at Danville, Va., a plant designed by Lockwood, Greene & Company, engineers and architects, Boston, to supply current to the Dan River Cotton Mills.

A brief summary of these tests is presented in the accompanying tables, and it should be remarked that the test on the 1,500-kilowatt turbine was conducted by the engineers of Lockwood, Greene & Company, while George H. Barrus, consulting steam engineer, Boston, made the test on 3,500-kilowatt turbine.

RESULT OF TESTS OF 1,500-KILOWATT ALLIS-CHALMERS STEAM TURBINE AT DAN RIVER POWER & MANUFACTURING COMPANY, DANVILLE, VA.

Load.	One-Half Load.	Three-Quarters Load.	Full Load.	25% Overload.
R. P. M.	1,500	1,500	1,500	1,500
Actual kw. per hour	745	1,169	1,478	1,849.4
Steam pressure at throttle, pounds absolute	175.4	177.2	173.4	172.2
Steam temperature at throttle, degrees F.	500.1	518	505	475
Superheat at throttle, degrees F.	129.6	146.6	135.5	105.9
Vacuum at exhaust nozzle, inches high	27.6	27.5	26.7	26.3
Steam consumption, pounds per kw.-hour	22.46	18.71	18.05	18.05

RESULTS OF TESTS ON 3,500-KILOWATT WESTINGHOUSE STEAM TURBINE AT DAN RIVER POWER & MANUFACTURING COMPANY, DANVILLE, VA.

Load.	One-Half Load.	Full Load.	25% Overload.	50% Overload.
R. P. M.	1,526	1,524	1,535	1,535
Actual kw. per hour	1,847	3,638	4,475	5,350
Steam pressure at throttle valve, pounds gauge	165.5	166.1	157.4	142.2
Barometer, inches high	29.25	29.88	29.07	29.1
Steam temperature at throttle valve, degrees F.	431.3	435.5	402.6	415
Superheat at throttle, degrees F.	58.5	62.2	33.5	53.3
Vacuum in exhaust pipe, inches high	27.18	27.09	25.6	24.38
Steam consumption, pounds per kw.-hour	18.42	16.73	18.55	20.09

The method employed in securing the steam consumption of the 3,500-kilowatt machine consisted in measuring the total water evaporated and from this deducting the weight of steam used by the condenser turbine, cloth hall and the leakage.

The measurement of the feed water was made by a four-inch Worthington piston meter, carefully calibrated.

The method of "orifice measurement" was employed for determining the amount of steam consumed by the condenser turbine. A plate one-eighth inch thick was inserted betwen a pair of flanges in the four-inch supply pipe and this plate contained two orifices, each one inch in diameter. Two gauge pipes were connected to the four-inch pipe on either side of the plate, carried down to a tee, common to both, to which a steam gauge was attached. The drop in pressure between the two sides determined the quantity of steam passing to the condenser turbine as the drop was referred to previous calibration of the orifice. In the same manner the steam used by cloth hall was ascertained.

The leakage of the plants, which embraced the boilers, steam pipes and valves attached thereto, was made one night after the main turbine was shut down. Just sufficient fire was left on the grates to maintain the steam pressure in the six boilers. The quantity of leakage was ascertained by observing the fall of water shown in gauge glasses and computing the quantity which this represents from the known measurements of the boiler at the water line. From this quantity was deducted the steam used in cloth hall and by the condenser turbine as per figures obtained by orifice measurements.

Orders for Railway Equipment Increase.

Considerable activity has been in evidence in the railway department of the Westinghouse Electric & Manufacturing Company owing to the volume of orders for railway equipment recently received by the Company.

The St. Joseph Railway, Light, Heat & Power Company of St. Joseph, Mo., has ordered a partial equipment of No. 307 interpole railway motors. The Denver & Inter-Mountain Railway Company has sent in an order for quadruple equipment of No. 306-B interpole railway motors with type K-35 control.

The Westinghouse Electric & Manufacturing Company has received a recent order from the Hutchinson Interurban Railway Company of Kansas for a double equipment of No. 92-A railway motors with type K-10-A control.

Among large contracts recently received by the Company is one for the Birmingham Railway Light & Power Company of Birmingham, Ala., including a 1,000-kilowatt sixty-cycle, self-starting rotary converter with the usual accompaniment of transformers, switchboards, glowers, etc.

The Capital Traction Company of Washington, D. C., has placed an order for two complete substation equipments—one covering a 1,500-kilowatt, twenty-five-cycle self-starting rotary converter with the necessary transformers and switchboards; and the other a 1,000-kilowatt, twenty-five cycle self-starting rotary converter with switchboards and transformers.

The Chicago Railways Company, of Chicago, Ill., has placed orders for equipment for the extension of its La Salle Street substation, including two 3,000-kilowatt, twenty-five-cycle, self-starting rotary converters, with the necessary transformers, and a ten-panel switchboard. A notable feature of this equipment is found in the fact that the

Westinghouse 3,000-kilowatt rotary converters are to be installed on foundations and with foundation bolts that were originally intended for 2,000-kilowatt rotaries of different manufacture.

Among orders for hydraulic development received recently by the Westinghouse Electric & Manufacturing Company is one from the Dakota Power Company of Rapid City, S. D., including three 500-kilovolt-ampere water-wheel generators, three 500-kilovolt-ampere water-cooled transformers for 24,000 volts and three 200-kilovolt-ampere self-cooled transformers.

The Georgia Railway & Electric Company, of Atlanta, Ga., has placed an order covering a 1,000-kilowatt sixty-cycle, self-starting rotary converter with transformers and switching apparatus. The Interurban Railway Company of Des Moines, Ia., has placed an order for a 300-kilowatt converter, self-starting, together with the necessary transformers and switching apparatus.

The Kokomo Public Utility Company of Kokomo, Ind., has placed an order for a 1,500 kilovolt-ampere turbo-generator unit; a 500-kilowatt, self-starting rotary converter, and the necessary transformers and switching apparatus. An order has also been received from the Metropolitan Street Railway of Kansas City, Mo., for a 3,000-kilowatt, twenty-five-cycle, self-starting rotary converter with three 11,000-kilovolt-ampere, air-blast transformers and the necessary switching apparatus.

Sound Waves Produced by the Oscillatory Discharge.

The oscillating spark discharge produces sound waves which are not directly recognizable by the ear, owing to their high frequency. Their presence has, however, been demonstrated by Messrs. Campbell and Dye, as described in the *Electrician* by a modification of the well-known Kundt's dust tube. A glass tube closed at one end is placed in front of the spark gap, in such manner that the sound waves are reflected at the bottom of the tube, forming loops and nodes. In order to ascertain the position of these loops and nodes, a small amount of lycopodium powder is sprinkled in the tube, when it collects in small heaps at the nodes. In this way the experimenters ascertained the existence of sound vibrations of a frequency lying between 140,000 and 800,000 periods per second.

Modern Diesel Oil Engines.

In a paper read before the British Institution of Mechanical Engineers, at the Zürich meeting, in July, F. Schubeler gives a survey of the practical development of the Diesel oil engine up to the present day.

It was the intention of the inventor of this engine to burn coal direct in the working cylinder, which however proved to be impossible, as the unburned residues could not be removed from the latter. This condition of things will remain unchanged and only oils will be used as fuel; these, however, being of the most composite properties, as will be described later on.

For dealing with liquid fuel the propositions made by different designers varied principally only in the arrangement of the air-pump and the construction of the fuel-valve. Generally, however, it can be stated that most of these propositions have disappeared and some have not even been carried out, all of them giving place to the well known Diesel principle with its characteristics: compression in the working cylinder up to the ignition temperature of the fuel (about 500 pounds or about 1,000 degrees Fahrenheit), and creation of the pressure of the injection air (600-850 pounds per square inch), by means of which the fuel is introduced atomized into the cylinder in an independent multiple-stage air pump. It is only natural that the development of this principle has caused some difficulty in the beginning. In the hitherto-known steam engine the working process takes place partly in the boiler and only partially in the working cylinder. The boiler, which has no moving parts, deals with the heaviest part of the process and furnishes the working fluid in a refined state to the working cylinder, whereas with the Diesel engine the whole process has to be dealt with in the working cylinder. That it has been possible within a respectively short period to develop the Diesel engine to such a degree as to enable it to compete successfully with the steam engine also for large units certainly proves the present-day skill and thoroughness of engineering. It may be stated that as regards reliability the Diesel oil engine can now be considered as fully equal to the steam engine, it being only a question of economy in each individual case which of the two prime movers takes the preference.

There was one principal difficulty which had to be overcome. The extreme high pressures and temperatures of the Diesel process put a limit to the dimensions of the cylinders, which will hardly exceed a diameter of thirty inches. This corresponds to an approximate cylinder output of 300 to 400 horsepower, assuming 150 revolutions per minute of the shaft and ordinary Otto cycle. Theoretically there would be nothing to prevent obtaining any desired output by arranging any number of cylinders side by side. Practically, however, it is not advisable to provide for more than six cranks, as a larger number would produce an inadmissible twisting of the shaft. Furthermore, such units require a great amount of space and would become extremely costly. These reasons called forth the necessity of seeking other means by which to increase the specific cylinder output of the ordinary single-acting Otto-cycle engine.

For this there are the following possibilities: (1) by carrying out the single-acting Otto-cycle machine as a double-acting one; (2) by adopting the single-acting two-stroke-cycle working process; (3) by adopting the double-acting two-stroke-cycle working process.

The double-acting Otto-cycle cylinder under (1) corresponds approximately to a doubling of the cylinder output. Almost the same result can be obtained by the procedure under (2), which, however, necessitates, as will be explained later on, the provision of special scavenging pumps. The solution under (3) would theoretically even quadruplicate the output of the ordinary Diesel engine cylinder and mean the adoption of the usual working process of steam engines, also for the oil engine.

The author will try in the following to throw a little more light on these various solutions in order that their respective advantages and disadvantages may be seen. As is known, this subject is for the time being a very disputed one and has not developed so far yet as to permit any definite statement with regard to which of the solutions will be ultimately adopted for the large Diesel units. It has, however, been ascertained that for smaller and medium-size units the single-acting Otto cycle takes the preference, the same involving the smallest working strain on the cylinder. Although this type of engine necessitates a more or less frequent cleaning of the internal parts, especially of the exhaust-valves, the author is informed that such machines have worked for periods of six to eight weeks without interruption,

even in cement factories and in mills.

The normal type of the single-acting four-stroke-cycle engine is a vertical one with trunk piston and without special crosshead. This has not only the advantage that the wear and tear of the piston is very slight, but also others with regard to the construction of the fuel-valve and the symmetric shape of the combustion chamber. The space required is comparatively small, which is frequently an important advantage, and permits a good utilization of the foundations upon which the enormous free forces of the cylinders are transmitted vertically.

The horizontal type, which is carried out by various firms, is specially suitable where small heights are essential and resembles in its construction that of the normal gas engine. The free forces are more awkward to deal with, and some difficulty also arises with regard to the formation of the combustion chamber and the introduction of the fuel into the cylinder.

The author will proceed first with the single-acting two-stroke-cycle engine and will deal with the double-acting engines later on. The first trials with a Diesel engine of this type were made some ten years ago. Owing, perhaps, to the choice of too small an output, and also some other inadequacies, this first attempt was not repeated for some time.

It may be useful to recall some of its principal features. An exhaust valve is dispensed with, the piston uncovering at the end of its outward or downward stroke, slots arranged in the cylinder wall through which the burnt gases escape from the cylinder. By means of a special scavenging pump an air-pressure of about four pounds is produced. This lightly compressed air enters the cylinder through a valve arranged in the cylinder cover, drives the burnt gas out of the cylinder and fills the latter again with a new charge of air as soon as the piston in its upward motion covers the slots. The air-valve being closed, the air is compressed as in the ordinary Otto-cycle engine and also the fuel introduced in the same way at the end of the upward stroke. The whole process of driving out the gases, and the refilling of the cylinder takes place within a very short time at the end of the outward or downward stroke. The length of the slots is about one-fifth of the stroke. With the ordinary Otto-cycle machine two entire strokes are available for this process, giving, however, thus only half the number of impulses, which can be obtained with the two-stroke-cycle type.

As the two-stroke-cycle process, this is the same as the well known one employed with the highly developed gas engine. It will be seen from the following that it is even more suitable for the Diesel engine. The two-stroke-cycle gas engine scavenges also at the stroke end with fresh air, the difference, however, being that at this stage of the process the combustible mixture is introduced into the cylinder by a special gas pump, and this even before the exhaust slots are entirely closed. It therefore cannot be avoided that part of the combustible gases escape unused in the exhaust, creating thereby a possible danger for the engine. With the Diesel engine the fuel is only introduced at the end of the compression stroke, thus preventing any losses of fuel and danger of preignition. The Diesel engine has furthermore the advantage that the rather bulky and power-absorbing gas pump can be dispensed with. With regard to the fuel consumption in general, it must, of course, be expected that the consumption of the two-cycle engine is somewhat larger with respect to the effective output than for the single-acting Otto-cycle engine. This must amount at least to the percentage of the energy absorbed by the air pumps. There must also be another increase due to the short cleaning and filling process of the cylinders, which does not allow as perfect a scavenging as with the four-cycle engine. With the latter under its worst conditions about seven to ten per cent of the cylinder volume (representing the compression space) is liable not to be fully replaced by fresh air.

As a main advantage it may be mentioned that the turning moment is much more favorable, and consequently the revolving masses for obtaining a certain degree of cyclic variation are much lighter. The two-cycle engine furthermore guarantees a better starting and better conditions for regulation, which is specially important for direct coupling with alternators. The space required is considerably smaller and the engine is also lighter and therefore cheaper. To give a figure, the difference in price between an ordinary single-acting four-cycle and a single-acting two-cycle engine for a capacity of 1,000 horsepower amounts to about twenty-five to thirty per cent, which figure would have to be considerably increased if larger units were compared. Furthermore, the lubricating oil consumption is somewhat smaller per horsepower, as the same cylinder and bearing dimensions are sufficient for producing about double the output.

It still remains for reference to be made to the chief advantage of the two-stroke engine, that is, the elimination of the exhaust valve (or two with larger units). Some difficulties cannot be avoided with the latter, as soon as the same attains larger dimensions. Generally speaking, the fewer working parts coming into contact with the hot gas the better. The scavenging valve (or valves) in the cylinder cover may be dispensed with. Only a part of the cylinder slots are then used as exhaust slots, the remainder on the opposite side being used for the introduction of the scavenging air. A special shape is given to the top of the piston to guide the current of the scavenging air and to guarantee a thorough removal of the burnt gases. The scavenging valve is thus removed from the high temperatures, and only the fuel valves and starting valves exposed to same.

The constructive details of the various types of Diesel engines may be described together, as a large number of the component parts remain the same whether used for this type of Diesel engine or the other. This especially applies to the fuel pump, fuel valve, air pump, piston, etc. The air pumps are today generally carried out as two or three-stage piston pumps with intercoolers. Whereas small units have as a rule an air pump attached to each cylinder, driven by a lever from the connecting rod, it is a general practice to provide for larger units one large common air pump producing the injection air for three or more cylinders. The pump may be arranged either horizontally or vertically at one end of the bed plate. This arrangement reduces the number of engine parts to be controlled and also the first cost. The valves are generally metallic ones, which alone are able to stand the high temperatures.

For lubricating the cylinders, special small oil pumps, that is, one for each cylinder, are provided. For bearings, connecting rods, etc., forced lubrication is generally advocated. The pump for the forced lubrication is driven direct from the shaft, and may be a piston or cog-wheel pump. The motors fitted with forced lubrication are totally inclosed, the dripping oil being gath-

ered in the bed plate and sucked up again by the pump after having passed through filters and coolers. Oil holes are bored in the shaft and connecting-rods, which take the oil from the bearings up to the respective crosshead pins and other places where lubrication is required. The cylinders are always cooled, the pistons only from a certain size upwards. The water is generally led to the engine by gravity and only under a small head.

For piston cooling several solutions are possible. In most cases a telescopic arrangement is provided. The disadvantage of this solution is the necessity of providing a stuffing box to prevent leaking water getting into the plate and mixing with the lubricating oil. With the stuffing-box arranged in the piston it is impossible to tighten it when the engine is running. If the same is arranged unmovable on the frame, heavy arms have to be attached to the piston, which involve a considerable eccentric strain on the latter, and which therefore cannot be recommended. In other devices joints are made use of, which, however, are subject to similar disadvantages. A very simple arrangement for the piston cooling, which does not require any stuffing box and the working of which is absolutely reliable, deserves mentioning. With this arrangement the water does not entirely fill the cooling space of the piston, the water being only squirted against the highly heated surfaces and draining off through a pipe which surrounds the spray pipe. By this arrangement all additional pressures and strains are eliminated. Some firms use oil for piston-cooling, which may have some advantages, but which, on the other hand, has the disadvantage of a smaller cooling effect owing to the smaller specific heat and the smaller coefficient of transmission of this liquid. If the oil is taken from the general oil system of the engine the cooling device for the oil has to be increased accordingly. The exhaust valves for smaller motors are not cooled. Some firms use no cooling device even for larger motors, which is an important constructive simplification, whereas other firms have the larger exhaust valves water cooled.

A question which is of the greatest interest both to the manufacturer and to the client is the choice of fuel. It is certainly very surprising that the results of chemical analyses of different fuels do not furnish exact information with regard to the suitability of the fuel for Diesel engines, so that this can only be decided by the actual tests. It happens that oil of a certain composion is quite satisfactory, whereas another of an absolutely similar consistency is unsuitable. It may be stated here that there is a large selection of cheap liquids available, the most important being: Crude mineral oils, mineral-oil residues (crude naphtha, mazout). Further, gas oils, that is, intermediate products of oil refineries from which the lightest constituents, such as benzine and petroleum have been distilled, and the gas oil-tars of water-gas works. More recently it has been found possible to utilize the by-products of the distillation of coal and paraffin, tar-, solar- and paraffin-oil. Explosions or danger of fire on account of the high flash-point are eliminated, and any quantities of such fuel may be stored without danger and without being subject to the restrictions made by law.

The different working conditions of the Diesel oil-engines naturally require different types. The piston speed is generally between 600 and 1,000 feet per minute, which cannot be reduced below a certain limit, as otherwise the slightest leakage could prevent the compression attaining the required amount. This is espeically important for marine Diesel engines when running the same dead slow. The piston speed can, however, be as low as 180 to 200 feet per minute for continual service.

For standard slow-speed single-acting four-cycle engines the number of revolutions lies between 150 and 300 at respective capacities of 1,000 to 15 horsepower. These engines have the best fuel consumption, but have also the disadvantage that they are heavy and expensive.

With regard to the actual costs per brake-horsepower-hour in assuming a fuel price of $12 per ton (which is certainly an outside figure) this will amount to about 0.22 to 0.36 cents, or about 0.32 to 0.4 cents per kilowatt-hour. These figures are the actual figures maintained during actual service, assuming of course that the engines are kept in good condition.

Exports of Copper.

Exports of copper for the week ended August 10, were 4,622 tons. The amount since August 1 was 8,536 tons.

Chemistry of the Silver Voltameter.

Among the questions relating to the chemistry of the silver voltameter which have been investigated more or less in detail are the following: (1) Effect upon electrolyte of the various septa employed in the different types of voltameters to separate the anode electrolyte from that of the cathode; these septa include (a) filter paper, (b) silk, and (c) porous pots of unglazed porcelain; (2) the effect of various kinds of impurities upon the weight of the silver deposit and the explanation of this effect; (3) the preparation and testing of pure silver nitrate free from traces of impurities which produce disturbing effects in the voltameter; (4) anode secondary reactions; (5) cathode secondary reactions; (6) preparation of the silver anode; (7) purity of the silver deposit.

Of these, says A. S. McDaniell in *Science*, the first question has been studied in greatest detail, principally because of the fact that it includes the cardinal differences between the various types in use by national standardizing laboratories. It early became evident that the different results obtained with the various types was due principally to the effect produced by these septa, and that two of them introduced errors of much greater magnitude than any ordinary variations in the conditions or in the purity of different samples of even commercially pure silver nitrate. However desirable it might have been to have devoted every energy to the preparation of pure electrolyte and to its protection from contamination during the experiments, it was necessary first to show just what the nature of the action of the septa might be. The results of the investigation of the effect of filter paper seem to show that ordinary filter paper is superficially covered with oxycellulose, which can be extracted with water but which again forms spontaneously when the filter paper is allowed to remain in contact with the air. This oxidation is probably due to fermentation. This oxycellulose solution (colloidal) very readily reduces silver nitrate solution to colloidal metallic siver. Permanent collodial solutions of silver have been prepared from concentrated aqueous extracts of filter paper. Furfuraldehyde, especially the polymerized variety, produces all the peculiar effects which have been observed with filter

paper, e. g., imparts to the electro-deposited silver a strongly striated and non-crystalline appearance. Other reducing agents produce similar effects but to a less extent. Cane sugar and starch do not produce these effects.

It is very probable that the final effect of the filter paper in increasing the weight of the silver deposit is principally due to the deposition of the colloidal silver (by cataphoresis) and also some of the protective colloid-oxycellulose upon the cathode along with the electrolytically deposited silver, resulting in a breaking up of the usual crystalline form of the silver so that it occludes greater amounts of electrolyte. Thus, an unweighable amount of colloid can increase the weight of the silver deposit by a quite appreciable amount. Of course, the weight is further increased by the actual mass of the colloid deposited, but this seems to be a small per cent of the total increase.

Silk, when first used, produces an effect very similar to that of filter paper, due to the ease with which it is partially decomposed into aldehydes. After repeated use in the voltameter, this aldehyde decomposition ceases, and it renders the electrolyte strongly acid, probably due to its decomposition into aminoacids. Since, in general, the effect of acid is to decrease the weight of the silver deposit, this fact probably accounts for the progressively decreasing values obtained with a voltameter with silk septa as compared to those obtained with the porous-pot type.

Porous pots, when prepared according to certain specifications, have practically no effect upon the electrolyte. If not so prepared, they render the electrolyte slightly acid and very faintly reducing in character. This very slight action is probably catalytic in character, and probably consists in a slight reduction of the silver nitrate to an equivalent amount of nitric acid. Of all the septa, the porous pot is by far the most inert.

Next to the presence or absence of strongly reducing impurities or certain colloids, the condition of neutrality of the electrolyte has the greatest effect upon the results. Fused silver nitrate when prepared according to the methods described in the literature is both slightly basic and also contains minute traces of reducing impurities which are very objectionable in voltameter work. Recrystalized silver nitrate (from neutral solution) is slightly basic, consequently the recrystallization must be made from acid solutions. This acid may be removed by recrystallization or by careful fusion, but the neutrality must be tested in either case.

There is no evidence of any secondary reactions at the cathode. The anode solution remains practically neutral, but if appreciably acid at the start tends to become neutral. The same is true when no septum is used. This indicates a secondary reaction of some sort at the anode. No evidence was found of the formation of reducing substances at the anode, such as a subsilver nitrate. The evidence obtained by other investigators of the formation of such substances seems to be at least partially vitiated by the fact that in some cases at least the anode solution was filtered through filter paper.

A Rotating-Electrode Oscillator.

Those who have been occupied with the investigation of high-frequency currents in wireless telegraphy, electrotheraphy, etc., are familiar with the very important role which the oscillator or interrupter takes in this work. This spark should possess certain special qualities having a considerable influence on wireless transmission and assuring regular and powerful oscillations. The sparking voltage and the resistance of the spark should remain invariable while the interval and the electric conditions of the circuit are the same.

The two electrodes of the spark gap being in communication with the terminals of the transformer become the terminals of an electric arc in the form of a hot spark. This is what happens when one electrode comes too near the other, when the frequency of the spark is too great or when the proper conditions of resonance are not realized. The gap becomes a conductor and allows a passage of the secondary current direct to the transformer which produces considerable heating and a dissipation of energy.

Several processes have been employed to remedy this difficulty, either in making the spark play in an insulating liquid (the Righi oscillator) or by passing the current of air between the electrodes, or by very rapidly moving the electrodes themselves in space to bring about ventilation. The new sparker described in a paper read by E. Roger before the French Society of Physics combines a spark with the necessary qualities, with a gap that is easily installed.

The new methods of sanding which at the present time are used in radiotelegraphy and are becoming more and more general, make use of the singing spark. It is quite well known that this kind of transmission permits a better oral perception of the signal in spite of the noise of other messages which are so frequent and disturbing in certain parts of the country, and responds better to the mechanism of the telephone, but to obtain good results it is necessary to employ sparks with high frequency and reduced lengths or to make use of high-frequency alternators having from 500 to 1,000 cycles. It is in cases of precisely this character that the sparker described has its advantages by assuring a powerful cold spark and avoiding the formation of an arc which would be the result of spark at a higher temperature.

The apparatus is composed of one electrode of a spherical form, placed opposite to and in the axis of another electrode of a cylindrical form. These two electrodes are mounted on insulated supports, one of which can be displaced laterally by means of a slide and vertically with a screw to assure perfect centering. The length of spark can be regulated during sending. A ventilator moved by an electric motor produces a current of air which escapes in the annular space between the electrodes where the sparks play.

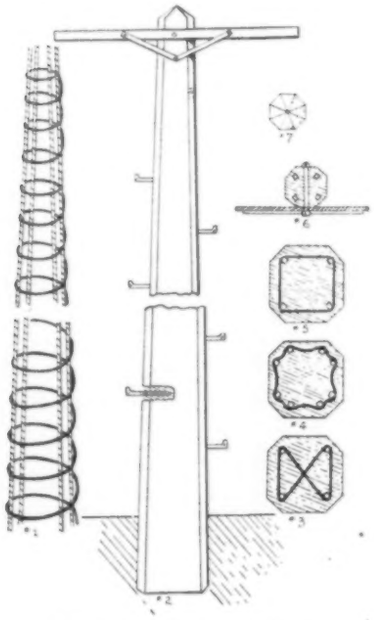
The spherical electrode has a movement of rotation imparted by the motor through a belt and the cylindrical electrode is placed in rotation by means of a friction clutch on the pulley driving the sphere which is furnished for this purpose with a flexible disk. The two electrodes turning thus in respect to each other on two perpendicular axes allow the spark to move across surfaces which are continually being moved and cooled, and the discharge of sparks is broken up into a number of multiple sparks breaking on the surface of the electrode. The active surfaces remain cool and in case of high-frequency sparks there is obtained by this means a very musical note, easily perceptible at very great distances at the radiotelegraph receiving stations. Moreover, this note can be varied throughout an octave by regulating either the length of the spark or the excitation of the alternator.

Central-Station Practice

MODERN AMERICAN CONCRETE-POLE LINES.

BY FRANK C. PERKINS.

For electric lighting, power and railway lines reinforced-concrete poles are now utilized with complete success and are said to be cheaper than cedar. A concrete-pole line across Whitewater River at Richmond, in Indiana, is shown in the accompanying illustration, the reinforced-concrete poles varying in length from 40 to 60 feet, the base being 20 inches in diameter and the top 7 inches. Concrete poles are



CONCRETE-POLE SECTIONS.

also used in railway service for supporting the trolley wires. These poles measure 28 feet in length with tops 7 inches in diameter, each concrete pole having a base of 12 inches. The various forms of reinforcement are indicated in the accompanying drawing. As electro-carbon twisted rods and spiral binding wire are properly distributed in the column of concrete the poles are not only substantial and durable, but also have remarkable elasticity.

A pole thirty feet in length will permit a deflection of thirty inches before the concrete cracks, while to obtain the above results would require about one-third greater horizontal strain at the top than would be sufficient to destroy a cedar pole of the same dimensions.

In accompanying drawing, No. 1 on the left, may be noted the four electro-carbon rods as they are placed in the cement body with the spiral binding wires pulled in place, while No. 2, in the center, indicates the shape of the concrete body as finished; and the steps and other bolts and holes which are easily made when the concrete is plastic. The other cross sections, No. 3 to No. 7, indicate different methods of binding and reinforcement.

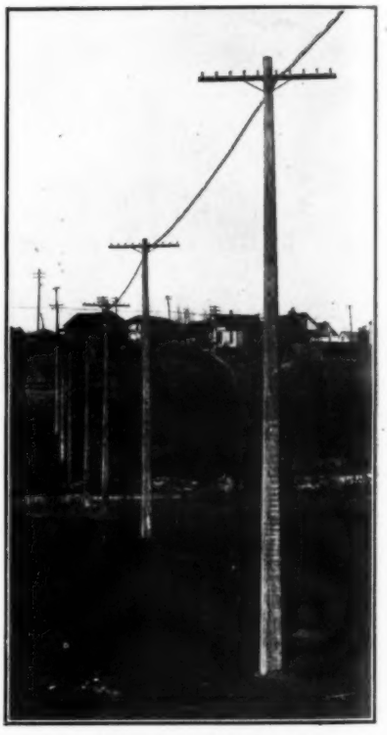
Even under tremendous strains the cracking of the cement, it is held, does not impair the strength of the pole in the least, for after this takes place the the reinforcement becomes active and takes the entire strain; and as the special rods are guaranteed to withstand a breaking strain of 50,000 pounds per square inch, it is an easy matter to understand why this class of construction has two or three times the strength of cedar.

It will be noted by the illustrations that the poles are square, with the corners beveled off two or three inches, so that the top of the pole is octagonal in shape. This not only gives it a handsome appearance, but leaves the corners substantial and avoids a sharp edge that would be liable to chip off.

Rods are placed within three-quarters of an inch of the surface of the cement at the corners and then bound together by a spiral wire encircling the four rods from top to bottom. This not only serves to tie the rods together, but prevents danger of the cement shearing off, as the rods have a tendency outward when the pole is subjected to a lateral strain. Another important function performed by the spiral binding wire is that it ties the concrete together and increases the flexibility of the entire body.

The smaller poles, up to and including thirty-five feet in height, are molded lying on the ground, and after they have been seasoned are set in place by means of a gin pole. The forms are laid with the butt near the hole and the reinforcement placed. Then the concrete is poured in and allowed to remain three to seven days, according to the weather. The forms are then removed so that they can be used again and the pole is held to season. This process requires about three to four weeks, and the poles are then ready to be set and used.

Poles forty feet in length or larger should be built standing, as this is the



A CONCRETE-POLE LINE.

most economical method. First the hole is dug, and then the form is set in place directly over it, and lined up straight and perpendicular temporarily guyed so as to hold its position. The spiral binding wires are then put in place and the rods drawn up on the inside of the form and set. After the reinforcement has been properly secured, the side of the form that was left out to receive the steel work is put in place and the bands or ties around the outside secured. The equipment is then ready to receive the concrete pouring.

CENTRAL-STATION SERVICE IN NEW ST. LOUIS POST OFFICE.

BY G. T. HADLEY.

The new postoffice in St. Louis is the largest workroom of its size in the United States. It is 290 feet long by 178 feet wide. The building is a substantial one of brick, consisting of this main workroom surrounded on three sides with marble corridors handsomely finished in Vermont marble, a mezzanine or second story, a basement and a sub-basement. The latter contains the boiler room, the fan rooms, the refrigerating plant and the big tunnel connecting with the Terminal subway. There are several very good reasons for the location of the present postoffice; avoidance of a long haul of mail, saving of time on account of better facilities, convenient to Terminal. The new postoffice represents combined efforts of a number of experts in the Treasury Department. James Knox Taylor is the supervising architect with E. L. Hesse as superintendent of construction.

NEW ST. LOUIS POST OFFICE.

The new postoffice has installed a three-wire direct current system for illumination. There are thirty-six electroliers suspended by steel cables from interior trusses; four 250-watt tungsten lamps or 1,000 watts for each electrolier. The fixtures were designed especially for this postoffice by a Chicago firm. The marble lobbies are lighted by seventeen electroliers equipped with opalescent globes, each fixture containing six forty-watt and one 100-watt tungsten lamps. Electric cluster lights illuminate the basement. Ornamental lamp standards adorn the main entrance, while bronze bracket lamps are used with good effect at other exterior entrances.

The telephone and messenger service will be complete in every detail. There will also be an electric clock system installed, comprising a master clock electrically driven and regulated twice each day from Washington, according to observatory time. Every clock in the building will in turn be operated by this master clock on the main floor.

The ventilating system includes a series of electrically driven "Siroceo" fans, nine in number, with capacity varying from 10,000 to 70,000 cubic feet per minute. The two enormous fan chambers are located in the southwest and northeast corners of the sub-basement. The free outside air is drawn into the building through sheet-metal ducts, cleansed from excess of impurities and warmed or cooled according to the season of the year. The air, after passing through the fans and the heating and tempering coils, is then washed and filtered and during the summer months is cooled and delivered to all parts of the building at a temperature automatically controlled by thermostats.

The boiler room is situated in the south end of the sub-basement and contains four 150-horsepower Scotch marine boilers with interior Morrison corrugated shell. To each one of these is attached a Hawley down-shaft furnace of the Dutch-oven type. These furnaces are guaranteed under normal conditions to consume ninety per cent of the smoke besides adding to the efficiency of the boiler apparatus approximately ten per cent. The boiler-room equipment is for the generation of steam for heating purposes only. All electrical energy for light and power is to be furnished by the Union Electric Light & Power Company.

The fact that a large establishment, erected and equipped in the most modern manner by the United States Government, is to receive energy from a central station for lights and motors, in preference to generating energy, is significant. It is not too much to assume that the decision in favor of purchasing current from the local central station was made only after careful investigation and assurance that the interests of the new postoffice were well served in so doing.

New St. Louis Electric Plant Nearing Completion.

The Laclede Gas Light Company's new electric plant at Mound and Mullanphy Streets, St. Louis, Mo., was completed August 15. The company will furnish electric light and power in any part of St. Louis. The electric plant cost $475,000, has a capacity of 8,000 kilowatts, is equipped with turbines and has all the latest machinery, including automatic devices for operating purposes. It is stated that electricity can be generated at less cost in the St. Louis plant than it can be transmitted from the Keokuk water-power plant.

The original schedule of rates ranged from 4 to 12 cents a kilowatt-hour for light and from 3 to 10 cents for power. A permanent and lower rate schedule, however, is to be prepared and will be made public in September. This brings the Laclede company into direct conflict and competition with the Union Electric Light & Power Company.

Including $475,000 for the new electric plant, the Laclede Gas Company is spending $2,310,000 for improvements and betterments. These include $500,000 for a twelve-story office building on corner of Eleventh and Olive Streets, of which the company will use six floors and basement; $350,000 for thirty-five miles of new mains; $100,000 for repairing and testing shops; $425,000 for new coal-gas plant and three water-gas sets at Second and Rutger Streets; remainder of expenditure provides two new immense gas holders and a pumping station, which increases the daily capacity of the gas works from 16,000,000 to 22,000,000 cubic feet.

A French Wireless System.

An all-French wireless system has been inaugurated to cover the whole world. Stations in South Oran and Dahomey will be in operation before the end of the present year, and one in Madagascar will soon follow.

An Excellent Boiler Record.

The Dayton Lighting Company reached the limit of its boiler capacity in the winter of 1909-10, and in order to pull through its peak loads contracted for extra current from the Citizens' Lighting Company. Anticipating material increase in demand for power for the next winter, the company installed new boilers, equipped with Taylor stokers. The winter load, however, showed an increase of 103 per cent over the previous year, which was so much greater than had been anticipated that the boiler capacity was still short. At this time the company could not obtain help from the Citizens' Lighting Company, for its load also had increased.

In order to carry the great load the new boilers had to be operated with the enormous overload. To do this both fan engines were coupled to the fan, the governors removed and the engines operated with their throttle valves wide open. For practically twenty-four hours each day for two months the plant was so operated, this condition being necessary because when the peak-load dropped off the firemen on the hand-fired furnaces quit work, thereby forcing the stokers to operate continuously at maximum capacity. The mechanical engineer for the Dayton Lighting Company states that these boilers developed 300 per cent of their normal rating. In this way this lighting company pulled through the heaviest part of their winter's load without asking for outside assistance.

The Hauserlake Concrete Dam.

On May 21 the first water passed over the crest of the new concrete Hauserlake Dam, located on the Missouri River, about eighteen miles below Helena, Montana. This dam is noteworthy, not only on account of its large size, but also because it replaces the large structural steel dam of triangular section which was completed in February, 1907, and failed with a year after going into service. This new concrete dam was designed by Charles T. Main, of Boston, while the Stone & Webster Engineering Corporation did all of the work with the exception of some extremely difficult foundation work executed by the Foundation Company of New York.

The new dam is located in the same place as the former steel one and is of the ogee type. From the head-race canal on the east side of the river to the west abutment it is 670 feet, while the spillway is 491 feet in length. It contains 88,000 yards of concrete and at maximum capacity stores 91,800 acre feet of water. From foundations to spillway crest it is 110 feet with a thickness at the base of 86 feet, tapering to 67.5 at the ogee section. At the height of nineteen feet over the dam extends a bridge supported by twenty-four piers, each two feet thick and spaced 18.5 feet in the clear.

The construction of this new dam was started in 1908, but proceeded slowly, as the cofferdam and temporary structures were washed out. In March, 1910, work was held up for several months by the main cofferdam being carried away. In building that portion of the dam below low water, the Foundation Company employed its pneumatic caisson method, and work was commenced in August, 1910. A number of wooden caissons were sunk to bed rock, filled with concrete, the spaces between them being sealed with the same material. The cofferdam thus constructed proved efficient, the concrete being then laid on bed rock.

The present power house is the same as the old and the equipment includes five 2,800-kilowatt units capable of producing 16,000 horsepower under an effective head of sixty-six feet. This Hauserlake power plant of the United Missouri River Power Company is one of the three large hydroelectric developments the company operates in this locality.

Coal Sampling by Purchaser and Dealer

That accurate methods in sampling coal deliveries will give nearly the same results from analyses by both the purchaser and the dealer, is a point made in a recent paper by Dwight T. Randall, of Arthur D. Little, Inc., chemists and engineers, of Boston.

In illustration, Mr. Randall gives the following results of coal sampled and analyzed by both parties from the same barge:

	Sample Taken by Representative of Consumer.	Sample Taken by Representative of Coal Dealer.	Difference.
Ash in dry coal...	10.48	10.14	0.34
B.t.u. in dry coal..	14,099	14.155	56

Another case shows that results will check reasonably well when samples are properly taken, and also that the results are not always as unfavorable to the coal dealer as he frequently assumes. A coal dealer employed a disinterested party to sample coal from a barge as it was unloaded, and a sample was taken by the consumer at his plant for one week. These samples were worked down and analyzed by separate laboratories, with the following results:

	Sample No. 1 Taken by Representative of Coal Company.	Sample No. 2 Taken by Consumer.	Difference.
Ash in dry coal...	5.96	5.67	0.29
B.t.u. in dry coal..	14,803	14,866	63

Such results can be obtained only when samples are taken and prepared for the laboratory by careful men who will follow instructions absolutely. It takes time to break down a sample properly and few laborers who are detailed to do this work realize the importance of the work, and a short or easy method is frequently used which may secure results far from right.

The fact that there may be small variations from the true heating value just as there may be in weight of the coal, and that these variations are as fair to the buyer as to the seller, must be recognized. They will tend to offset each other during a period of a year. It is better to know within one per cent of the weight and of the heating value of coal than to have no information about it. It is possible to determine both with greater accuracy if only reasonable care is used.

Danube Water Power.

Two great projects for employing water power for the generation of electric power are now under consideration in Hungary and Croatia. One, due to Albert Bass & Company, of Basel, is to use the Danube in its flow from Pressburg to Raab, a distance of about 40 miles in West Hungary. A navigable canal is to be dug for navigation and irrigation and three reservoirs are to be made, at Pressburg, Wieselburg and Raab, respectively, to supply 40,000 horsepower for driving dynamos. The total cost will be nearly ten million dollars. The other proposal is to utilize water power at Zeng on the Adriatic coast of Croatia. Here from 60,000 to 80,000 horsepower can be generated to supply Fiume and the rest of the Austrian coast with light and power, and especially for railway traction. The cost of this larger undertaking, it is said, would approach $20,000,000.

Electric Lighting and Illuminating Engineering

Ornamental Lighting at an Amusement Park.

One of the new features this year of the world-wide famous electric illumination at Coney Island is the large number of decorative lamp posts installed along Surf Avenue, the most popular thoroughfare of this resort. These posts are of the type known as the "Brighter Brooklyn" post, containing five 100-watt tungsten lamps, one pointing up and the other four pointing down, on a very artistic standard.

NIGHT VIEW OF ORNAMENTAL STREET LIGHTING INSTALLATION AT SURF AVENUE, CONEY ISLAND.

These posts at Coney Island have been installed at the expense of the individual operators of amusement concessions, and they add materially to the beauty and brilliance of the night spectacle.

The accompanying illustration shows fourteen of these posts installed in front of Steeplechase Park, one of the large Coney Island enterprises. They were installed under the direction of the Edison Electric Illuminating Company, of Brooklyn, which company furnishes the current.

Modern Illumination in Old Church.

The method of electric lighting employed in the famous church of St. Mary's, Redcliffe (Bristol), furnishes an interesting example of the grafting of the new on to the old. This church is renowned for its associations and beautiful old interior, and it might naturally have been expected that there would have been some hesitation in introducing modern illuminants.

The method adopted has been to outline the arches on either side of the main aisle with clear-bulb metallic filament lamps, and in some cases the straight lines of the architecture have been followed in a similar manner. By this means the lamps are kept out of the direct range of sight, and the brightly illuminated stone immediately behind them probably serves to tone down the contrast between their brilliancy and the suroundings.

In addition to these lamps there are chandeliers equipped with imitation metallic-filament candles.

A New Electric Lamp.

A new electric lamp was recently described before the Académie des Sciences which is a modified form of mercury-vapor arc. According to some particulars given in the *Revue des Eclairages*, the arc is formed in vacuum between an anode of tungsten and some mercury at the other end, and is struck by means of a small electromagnet which brings the tungsten anode and mercury into contact. The light emitted is said to be remarkably white, combining as it does the blue of the mercury arc with the whiteness of incandescent tungsten.

The energy consumption is low, being given as 0.45 watts per candle. The lamp as at present arranged works at a pressure of twelve volts, but it is hoped that this value may be increased by the use of some inert gas in the bulb, thus permitting operation on circuits of higher voltage.

Cost of Car Lighting.

The experience of French railway companies with different types of car lighting has recently been made public. The lamp-hour is taken as the unit of comparison, although the electric lamps give twenty-five candlepower, the gas lamps twenty candlepower and the oil lamps seven candlepower. The cost of oil is taken as 15 cents per kilogram, of gas $1.00 to $1.25 per thousand cubic feet, and of electric power as 0.9 cent per kilowatt-hour. A comparison is given in the accompanying table. It is seen that electric lighting is the cheapest, while giving the most light. Oil is most expensive.

	Cost in Cents.		
	Electric.	Gas.	Oil.
Cost of energy	0.032	0.098	0.404
Labor	0.042	0.066	0.238
Repairs and maintenance	0.116	0.074	0.112
Interest at five per cent and depreciation	0.160	0.200	....
Cost of extra haulage	0.038	0.058	....
Total	0.388	0.496	0.754

Station Lighting Controlled By Block System.

On the Coast division of the Southern Pacific Company the employees of the signal department have installed with great success at six stations an automatic lighting device which is operated entirely by means of the block signal. The signal supervisor of the division states that a saving of seventy-five per cent in the cost of lighting is made. The lights at a station burn only when a train is approaching, standing at the station or departing therefrom. The length of control of the lights depends entirely upon the distance between the blocks at the station.

Telephony · Telegraphy and Wireless

THE MERCADIER-MAGUNNA MULTIPLEX TELEGRAPH SYSTEM.

BY C. L. DURAND.

After working for a number of years upon their system of multiplex telegraphy by vibratory currents, Professor Mercadier and Engineer H. Magunna, the inventors, have now succeeded in eliminating all the various difficulties which were encountered, and it may be said that the apparatus is able to meet with the most severe tests which can be required in practical telegraphy. This was very well brought out in the tests which were made under the direction of the French Government over a line from Paris to Lyons, about 280 miles. On this occasion a quadruplex Baudot printing telegraph of the government type was operated by direct current along with a sextuplex Hughes printer by vibratory currents, making five transmissions each way. Counting each Baudot instrument at 1,550 words per hour and a Hughes instrument at 1,800, the total is 10,800 words per hour. On the usual direct-current method, only the quadruplex Baudot method can be used, so that the capacity of the line is nearly tripled. With Morse sounders or tape receivers the advantage is still greater, and the line will carry four times the usual number of messages.

The Mercadier-Magunna system depends on the use of vibratory transmitters sending alternating current on the line, each at a standard frequency. At the other end is a set of selective receivers, so that each current is received in a separate instrument. Three messages can be thus sent each way in practice. However, this does not prevent sending messages at the same time by the usual direct current, as alternating and direct current are sent over the same wire by using the Van Ryssel-berghe connection. With the Morse signals the difficulties are even less than with printing telegraphs such as are used in Europe. Given a line which is duplexed as usual on direct current, we can add three messages each way by using the vibratory method, that is, six messages counting both ways. The capacity of the line is now eight messages against two on the usual method. The new apparatus has very little complication, and another point is that none of the regular standard instruments such as sounders, etc., need to be modified. Dots and dashes are sent by key in the same way as before. Where alternating currents is used on the line, the signals are always received as direct current, by the use of relays and local battery circuits.

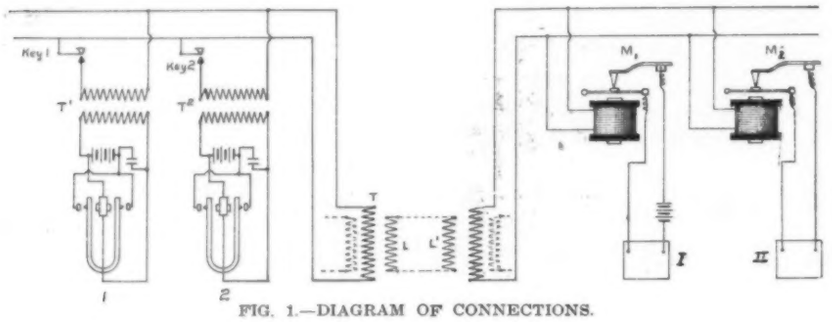


FIG. 1.—DIAGRAM OF CONNECTIONS.

The transmitter uses a tuning fork which is kept in vibration by an electromagnet placed between branches. One wire of the magnet is connected to one pole of a storage-battery and the other wire to the metallic mass of the fork. Each prong of the fork carries a contact by which the circuit is broken in the usual way by the action of the magnet upon the prongs. In order to receive the alternating current set up by the vibration of the fork, a transformer T_1 (in Fig. 1), has its primary coil connected in shunt on the ends of the electromagnet. The wear on the contact points of the vibrator is avoided by the use of a condenser. The inventors find it best to use tuning forks whose pitch lies between 500 and 875 complete vibrations per second. In practice there are used three tuning-fork transmitters and the same number of selective receivers. In station No. 1 the transmitters are designed for 575, 725 and 875 cycles respectively, and the receivers at the other end are tuned to the corresponding values.

In Fig. 1 are shown two such tuning fork transmitters 1 and 2, with the transformers T_1 and T_2. The secondary coil of the transformer is connected to the common circuit through a Morse key. The circuit then goes to the primary of the line transformer T (shown in heavy line), which is a short and heavy winding. The transformer has two secondary coils having a long winding of fine wire. One of the coils, L, sends the alternating current into the line wire, while the second coil (shown in dotted line) is used to regulate the circuits. At the receiving end the current is received in a like transformer L′ T′ and from thence it goes to the common circuit of the vibratory selective receivers or monophone relays M_1 and M_2. Monophone relay M_1 responds to the current of 575 cycles sent out by transmitter No. 1, and it makes contact for a local battery circuit on receiver I. A like effect occurs with monophone relay M_2 and receiver II, which is tuned for a frequency of 725. The operator can use key 1 to send Morse signals upon the line and such signals are received in the corresponding apparatus at the other end, so that both operators can send messages independently. In the same way the

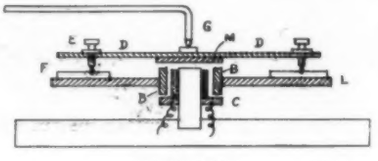


FIG. 2.

operators at the second station can send messages to the receivers which are located at the first station, so that as many as three messages are sent over the line in each direction, or six messages in all, by the use of vibratory currents, not counting the messages which are sent at the same time by direct current.

One of the interesting points about the system is the use of a special type of vibrating receiver in order to select the waves of different frequencies which are sent over the line. The inventors designed a receiver which they call "mono-telephone" on account of its resemblance to a telephone. It uses a metal disc which is made to vibrate by the action of an electromagnet, but it differs from the usual telephone principle from the fact that it will be set in vibration by only the waves of the

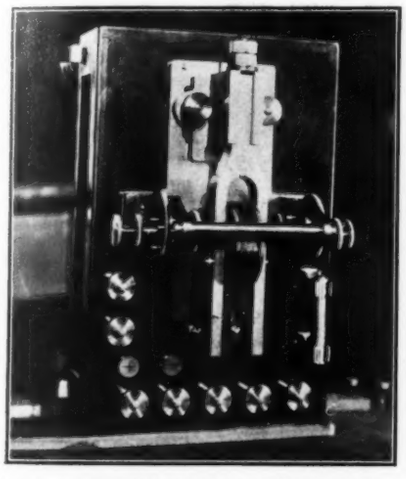


FIG 3.—TUNING-FORK TRANSMITTER.

exact pitch for which it is tuned. For instance one of the monotelephones is tuned so as to respond when the operator sends signals by using waves of a frequency of 575, but for other waves it produces no effect whatever.

In designing such instruments, the inventors make use of the properties of vibrating plates. When a metal plate is placed horizontally and is sprinkled with sand, and the plate is then made to vibrate by striking the edge, the sand is driven off from some portions and is collected upon others. The sand tends to collect upon the nodal lines, where the vibratory movement is zero and on the contrary it is driven away from the strongly vibrating parts. The form of the nodal lines depends upon how the plate is vibrated. Should we vibrate a circular plate by means of an electromagnet placed under the center, we obtain a circular nodal line which corresponds to the first harmonic of the fundamental tone of the plate. Should we now fix the plate by three supporting points P lying on the nodal line, such a plate will vibrate at only the pitch corresponding to the first harmonic, and for any other pitch it will be silent. The plate is made to vibrate by mounting a soft-iron disk armature at the middle and placing an electromagnet

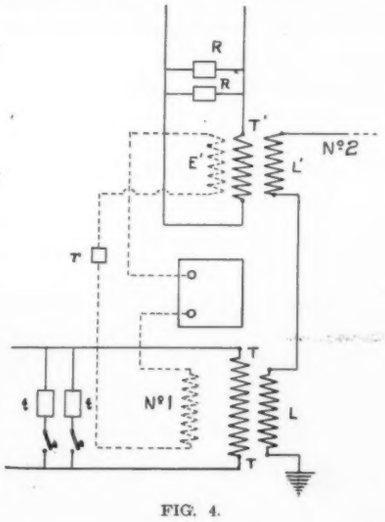


FIG. 4.

underneath. Such a disk, which can be made of steel, copper, silver, etc., is shown at D (Fig. 2), and it is held by three screws E upon sliding supports F so as to hold it on the base L and also leave it free to vibrate. Under the plate is a specially annealed soft-iron disk M which is acted upon by the electromagnet A. Around the iron core A is a concentric soft-iron ring B, and below is a permanent magnet C which is placed so as to magnetize the soft iron parts and form an annular magnet having an equal circular distribution of the lines of force. The magnetic circuit also includes the armature M. It is found that such a method is the best for securing the vibration of the disk when the coil receives alternating current. The pitch of the disk depends on its diameter, so that each monotelephone uses a disk of different diameter. The diameter of the nodal line is 0.64 of the diameter of the plate. Such plates are adjusted to the exact pitch by comparing a set of standard tuning forks, and they will respond strongly for a current of the right pitch, but are inactive when the current differs from this by only a small amount, so that the monotelephones form a very sensitive selecting system. Such monotelephones could be used to hear the messages by sound, but it was desired to make them act as relays in order to operate printing telegraphs or Morse tape. On the disk is soldered a platinum plate upon which bears a contact point carried on the end of a lever. The lever is mounted on pivots and the pressure at the contact is adjusted by a counterweight. When the disk vibrates, the lever which has been so adjusted that its natural vibration is much slower than that of the plate, is unable to follow the vibration of the disk, so that there is a considerable increase in the resistance at the contact of the lever and plate. A direct current passes through this contact for operating a local relay, and the adjustment is such that when the current is diminished the relay will make con-

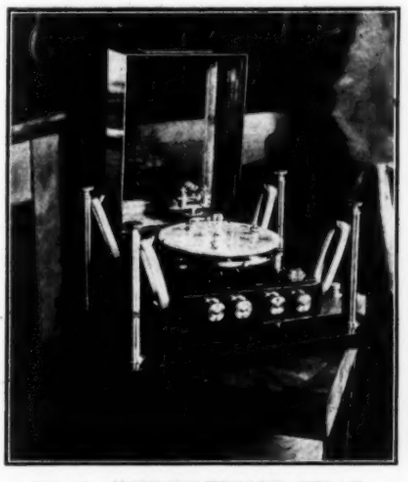


FIG. 5.—MONOTELEPHONE RELAY.

tact and thus operate a Morse receiver or a printing telegraph. Each signal sent over the line by alternating current gives a like signal in the direct-current receiver.

In Fig. 4 is shown the method which is used to keep the signals sent from a station from passing in the receivers of the same station. At t t are the transmitters with their keys and at T L the line transformer (No. 1), corresponding to the one which is shown in Fig. 1. A second and like transformer E′ T′ L′ (No. 2) is also used. Each transformer has a primary coil T or T′ and two secondary coils E L, E′ L′. The coils E and E′ belong to what is known as the choke circuit, this being shown by dotted lines, and this circuit includes an artificial line and an adjustable resistance *r*. When a current is

sent from the transmitters t, it induces currents in the secondary of transformer No. 1. Such impulses arrive in coils E′ and L′ of transformer No. 2. By regulating the artificial line, these currents are made to have the same value and are also thrown out of phase by one-half cycle. When these two currents pass in coil E′ and L′ their inductive effect is equal and opposite and in consequence zero upon the middle coil T′. The receiving instruments are mounted in the circuit of T′ and thus receive no current. However, when signals are sent in upon the line, a current is induced in T′ so that the receivers are operated. The current also induced in E′ E has no effect in this case.

To secure a better operation, the tuning forks are given a different pitch from the corresponding receivers in the same station, and the difference between the highest and lowest pitch is lessened as much as possible without interfering with a good selection by the monophone. In fact the above mentioned compensation is only approximate when different frequencies are used and is only exact for one given period, so that it is required to work with frequencies lying as near together as possible. These are chosen at 575, 725 and 875 for the transmitters and 500, 650 and 800 for the receivers of the same station.

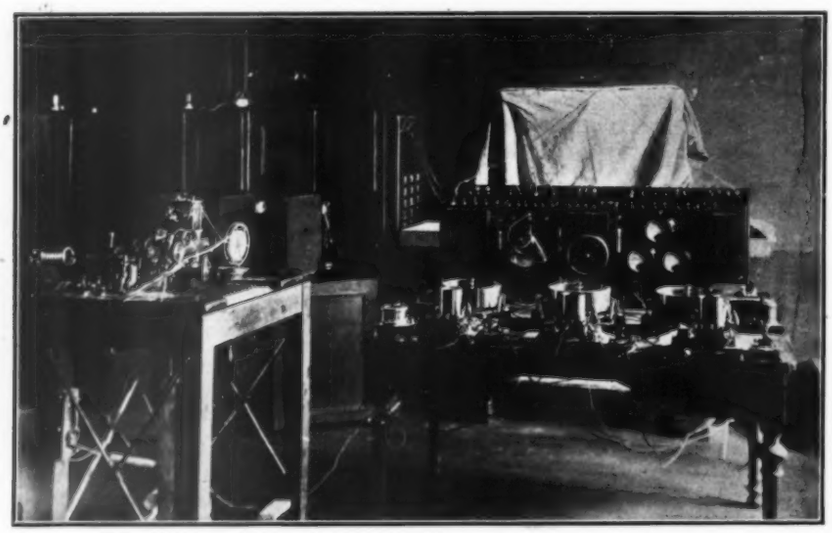


FIG. 6.—STATION COMPLETELY EQUIPPED

Largest Wireless Station.

A feature of the Panama Pacific Exposition which will be held in San Francisco in 1915 will be the wireless-telegraph station on Telegraph Hill. It is planned to erect the largest station ever built on this occasion, by means of which the passage of the fleet of battleships through the canal can be continually signaled. Its range must therefore be about 4,000 miles.

Wireless on Aeroplanes.

Efforts are being made by the Navy Department to perfect a system of wireless communication between shore stations and aeroplanes, recognized as destined to play an important part in any future war. Captain Mayo, commandant of the Mare Island Navy Yard, has been authorized to conduct experiments with models of aeroplanes suspended in the air and equipped with wireless outfits, to determine whether or not the frame of an airship will act as a ground for the type of wireless apparatus used by the navy and permit communication with the shore.

The models will be suspended in insulated ropes between smokestacks at the navy yard and an effort made to send a message to the wireless stations at San Francisco and Yerba Buena. More experiments with the wireless telegraph in conjunction with aeroplanes are looked for as soon as the naval aerial school at Annapolis is opened.

One important point in dispute at this time is whether the wires necessary to establish communication should be erected on top of the machine or suspended from the bottom. In the latter case, many aviators contend, the wires might interfere with the propeller.

Wireless Boat Propulsion.

Another public demonstration of the method devised by Christopher Wirth of Nuremberg, Germany, for the controlling of motor-boats by wireless waves was made on July 6 for the special benefit of invited members of the Deutsche Flottenverein. At the appointed hour the experimental boat was towed to the middle of the lake (the so-called Wannsee), having first been carefully inspected by some who wanted to make sure that no person was concealed in the boat. Antennæ stretched above the vessel were to act as receivers for wireless waves which in this case were sent from antennæ attached to a collapsible "Komet-mast" tower on the shore. The boat itself was equipped with a storage battery and a correspondingly wound motor for propelling it, leaving the wireless to be used only for controlling and steering the vessel.

AERIALS AT LIGHTHOUSE.

Owing to a poor tuning of the wireless apparatus, the response was not as prompt as was expected, it being claimed that from one to two seconds is ample to show the same when the receiving and sending instruments are properly tuned. However, the vessel did respond to each "command" flashed from the shore, threading its way between the rowboats, sailboats and motorboats which were present in large numbers. The receipt of each signal was acknowledged by the lighting of a colored lamp, an arrangement that should

prove of great value when a boat is to be manipulated from a distance at night. A green lamp indicated steering to the right, red to the left and white straight ahead. A blue light meant that the motor was connected for forward motion and yellow for backing.

In the discussion by the German Fleet Society of the problem of the wireless control of distant crafts, two promising uses were emphasized. One was the wireless manipulating of torpedo boats so that these may be dispatched close to the enemy's vessels without exposing any lives. At present, the demand for a reasonable protection of the crew makes it advisable to discharge the torpedoes at considerable distances from their intended target, with a resulting uncertainty which increases rapidly when the vessel aimed at is in motion. If the distance from the torpedo boat to the enemy's vessel could be decreased

CREWLESS BOAT OPERATED BY WIRELESS.

without risking lives, the probability of striking the hostile craft might easily be increased from the present 10 per cent to a possible 90 per cent. In other words, with a self-propelling torpedo costing about $3,000, the outlay per effective one would be only $3,333 as against $30,000.

Another promising possibility is that of directing and controlling an aeroplane by wireless waves so that it may be sent out as a photographic scout over an enemy's camp. If both the airship and the camera can be controlled from a distance, it should be possible to obtain a series of photographs showing the distribution and fortifications of the hostile army without exposing a single man to the enemy's fire. Of course both the torpedo boats and the aerial crafts built for wireless control could be considerably lighter, smaller and less costly than corresponding vessels carrying human operators.

Pictures of this latest test are not yet available, but the illustrations of the crewless boat as equipped by Wirth, Beck & Knauss of Nuremberg and of the aerials at the lighthouse from which the previous experiments were conducted, will show the general arrangement.

Wireless Installation in the Navy.

Ground has been broken at Charleston, S. C., for the most powerful wireless station on the Atlantic Coast to cover the whole North Atlantic Ocean. Messages can be carried 3,200 miles by the new plant, reaching the north coast of Ireland and the Caribbean Sea. From the sixtieth parallel on the north to the tenth parallel on the south, ships can be maintained in constant communication with the naval center.

Ocean liners between American and British ports will at no time be beyond reach of this new station. Coast shipping from above Newfoundland to south of the Gulf of Mexcio will be able to keep in touch with Boston.

The new apparatus will be a five-kilowatt Telefunken high-frequency wireless machine, with two aerial poles each 170 feet high.

Wireless Messages from Automobile.

A number of cadets from a military academy of the Northwest are now making a tour of about three thousand miles through the east and back to Chicago in four automobiles, whose engines drive the generators for the electricity of the wireless apparatus with which each machine is equipped and the machines are operated about thirty or forty miles apart, communication being maintained by means of the wireless.

Each machine is provided with an extension mast, while balloons, also forming part of the equipment of each machine, can be utilized for carrying the antennæ wires to any desired height. The expedition anticipates visiting Washington, New York, etc.

Wireless Station at Danzig.

The wireless station opened at Danzig on May 15, 1911, for general communication with ships at sea works from 6 a. m. till midnight in connection with the ordinary telegraphic service. The T-shaped antenna is carried by the telephone tower and a mast about forty yards distant and rises to a height of 150 feet. The power is provided by 220-volt continuous current from the Danzig Municipal Works. The energy in the antennæ is 2.5 kilowatts. Both senders and transmitters are provided with variable wavelength scales. The normal range is nearly 400 miles by day and twice that distance by night, but the station has interchanged messages with the *Hohenzollern*, when it was at Venice, 1,370 statute miles away.—*Electrical Engineer.*

Pedersen Wireless System.

Many experiments have recently been made in the rapid transmission of wireless messages by the Pedersen system. The first attempts were made between Esberg and Lyngby, in Denmark (167 miles), then between Lyngby and Cullercoats (560 miles,,) and finally between Lyngby and Knockroe, in Carlow, Ireland (900 miles). Speeds of 300 words per minute have been attained. The transmitting station works with a Poulsen generator, so that it acts by undamped vibrations. For signalling the primary circuit is not used, but only a small part of the self-induction in the antennæ is short-circuited. Half a per cent out in the tuning is good enough to enable clear signals to be given by the receiver, which is fitted with a crystal detector and a string galvanometer. The signals are marked on a tape automatically.—*Electrical Engineer.*

Industrial Power

Electric Drive in Paper Mills.

One of the trades in Scotland where electric power is vastly benefiting the manufacturer is that of paper making. In some cases the power is obtained from the private installation in the works, but wherever possible the services of a power-supply station are made use of. From the economical side the advantage over steam is, of course, undoubted, and there is also the great gain in simplicity and handiness in working.

The aim of the paper maker is increase of output. At one time a speed of sixty-five yards was regarded as exceedingly satisfactory, but to-day a speed three times this is secured and that with the much wider web given by the introduction of the latest type of machine. Another important consideration is speed regulation, thereby enabling different classes of paper to be made on the same machine. It required some time and experience of paper-mill methods before the electrical engineer could supply the necessary variations of speed without waste of current. But this has been done successfully.

While several methods of regulation have been adopted, what may be taken as the ideal method depends on varying the voltage at which the paper-machine motor is supplied. This is effected in one of two ways. There is either a separate starting dynamo for the motor about the same dimensions as the motor itself and supplying a current of varying tension by means of a regulator conveniently placed in the immediate neighborhood of the paper machine; or the current can be taken from outsid. mains and transformed in a smaller dynamo, which may be about half the size of the motor. Either dynamo is driven by a belt from a shaft or by a separate motor. The dynamo is excited by an independent current from a small exciter, which may be coupled to the starting dynamo, or run from an outside source.

An illustration of the use of the second method, of taking current from outside mains, is seen in a paper mill which is supplied with a 120-volt direct current for lighting purposes. The variable motor uses at the maximum speed of the web—about 400 feet a minute—100 horsepower, requiring about eighty kilowatts. The transforming dynamo takes half this, or forty kilowatts. By means of control resistances its voltage can be made anything up to 120 volts, by steps of ten volts at a time, and this voltage can be added to or subtracted from the 120 volts. Thus, voltages of 10, 20, 30, etc., up to 240 can be obtained, and are sufficient for all practical variation in speed.

Two motors are required for the typical electric drive, one permitting of comparatively small changes of speed for steady work, and one by means of which the shaking motion and the dry end can be worked within wide limits of variation. Very slow travel is necessary for such operations as wire washing, putting in felts, starting, etc. A motor requiring such extensive regulation must be rather larger than one for which such regulation is not required, and the starting and regulating apparatus in proportion.

One system of regulating depends on the use of a three-conductor arrangement, with two different voltages, say, 150 and 75 volts, and the motor armature can therefore e driven with 75 150, or 225 volts so as to give three separate speeds. This action is often combined with the use of a shunt regulation, and just one two-step cone pulley, and gives a range of speeds from one to twelve. For wire washing, etc., the main voltage is altered. The first method of regulation in use was by means of weakening the field. The speed could be made double the lower limit through several intermediate stages, and by combining this method with regulation of the current the requisite slow travel was obtained.

As showing the extent to which electricity is adopted in the paper trade it may be mentioned that one firm of engineers alone have already supplied an aggregate of more than 100,000 horsepower of motors to paper mills.—*Electrical Engineer.*

Electricity in the Cotton Mill.

The electrical specialist should bring to the cotton mill a knowledge of the possibilities of electrical distribution of power and intelligently apply that knowledge to secure the best results from each separate cotton-working machine, according to John P. Judge, who in a paper presented before the Southern Textile Association at its recent meeting in Greenville, S. C., presented considerable data relative to electric drive in cotton mills.

Before the advent of the electric motor the only available method of power distribution was by shafting and belt or ropes, and it would therefore have been a waste of time to have investigated the possibilities of the various machines if operated under conditions not attainable. In the begining of the era of electric driving in cotton mills small motors were prohibitive in cost and did not have very good characteristics, consequently large motors were generally used, the system being designated as group driving. It was a great improvement over the old system, which might be called the unit drive, whether from engine or water-wheel. Unfortunately in the early days of group driving few comparative tests were made, and less published. In fact, in the beginning it was not thought that an increased production could be made. It may be interesting to note a few tests illustrating the variation in loads in mill driven by large group motors: Picker-room, load variation thirty-five per cent; cardroom, load variation thirty per cent; spinning-room, load variation twenty-six per cent; weaving-room, load variation seven to twelve per cent.

These tests were made in a new well-managed mill during an average day's run.

About four years ago the perfection

of group drive was reached in the four-frame drive for spinning frames. This has been used successfully in a large number of mills both south and north. While it was a marked advance over all other group-driving systems, it retained the worst element of the old spinning-room drive, which is the nearly vertical driving belt to the frame. There is some slippage in every belt, but much more in frame belts than most others, because they are small and it is impossible to keep lint off of them. Numerous tests show that the speed of a cylinder will often increase three per cent immediately after cleaning a frame belt and will drop back again after one hour running. The irregularities of belts cause jerks, which are a prolific cause of broken ends and therefore limit the speed and production.

By this time small motors of low cost, exceedingly hardy construction and having almost as good characteristics as the large motors had been developed, and naturally the electrical specialist turned his attention to the individual machines. He soon learned from the specialists in the mills and from the specialists in the manufacture of the machine that certain limitations which had been generally accepted as inherent in the machines were really due to the method of driving. Small motors individually applied would eliminate these handicaps and permit the operation of each cotton-working machine in a manner best suited to its requirements and possibilities.

It seems almost incredible that we should have so long installed large motors to drive such high-speed machines as pickers, because it generally required a step-down from the motor to a line shaft, step-up from line shaft to counter and another step-up from counter to beater shaft. The first commercial application of individual motors for driving pickers was made in 1908.

The paper describes a mill built near an old mill, both owned by the same company, electric drive being installed in the former. About a year later the company ran the two mills for one month, twenty-five days, on the same counts with the same superintendent and same staple cotton. The superintendent made a test on his own account without any outside help or advice, and reported the result as follows: Both mills working No. 20 hosiery yarn, the belt-driven mill on single roving, the electrically driven mill on double roving:

	Spindles.	Production in lbs.	Production per Spindle.
Belt-driven mill	8,208	81,549.44	9.935 lbs.
Electric mill, ind. motors	7,680	87,154.60	11.35 lbs.

Showing 14.18 per cent more production for the motor drive, or deducting five per cent for the difference between single and double roving, a net gain of about 13.5 per cent.

Excavating by Electric Power on the Champlain Barge Canal.

Electric power has been utilized to great advantage in the excavation of the Champlain barge canal in the Lake Champlain district. A hydroelectric power plant supplied the current to the electric excavator over a long-distance power-transmission line, and as the excavator is moved from place to place, its step-down-transformer substation is transported as well, tapping on to the high-tension line wherever desired.

EXCAVATING MACHINE.

TRANSFORMER STATION.

The electric excavator is shown in the accompanying illustration with the bucket digging into the bank of a cut on the Champlain barge canal, while in the center of the a picture in the background may be noted the transformer plant connected with the power line, a closer view also being shown of the transformer panel and oil-switch mounted on a skid for transporting along the high-tension pole line.

These electric excavators were utilized for work between Dunham's Basin and Fort Edward, and in working in the prism from lock No. 8 to a point 300 feet south of East Street, took out about 82,300 cubic yards operating three eight-hour shifts.

The electric hoisting equipment and controlling apparatus installed within the cabin of the electric excavator includes a single-drum swinging hoist, operated by a motor supplied with a current having a pressure of 550 volts, as provided by the secondary conductors of the portable transformer. plant, the primary wire being connected to the high-tension pole line. This motor driving the single-drum swinging hoist on the excavator operates at a speed of 723 revolutions per minute and develops twenty-two horsepower under normal load. The main double-drum hoist on this electric excavator is geared to a three-phase motor of 112-horsepower capacity, operating at a speed of 750 revolutions per minute.

Coaling at Sea by Means of Electricity.

An important test of coaling at sea is shortly to be made with the new naval collier *Vestal* in connection with which test the United States Navy Department has ordered the employment of the battleship *Virginia*. The device used for coaling at sea is an electric hoist and it is required that the delivery of coal from the collier to the battleship shall be at the rate of at least sixty tons per hour for not less than eight consecutive hours, the speed of both ships being in the neighborhood of eight or nine knots, and the collier towing the battleship.

Some of the naval officers do not believe it is advantageous to undertake coaling at sea; at least with any attempt to effect a transfer of fuel while both collier and receiving vessel are under way. It is pointed out that this will require a special gear in the way of winches and other apparatus, and that in time of war, with the employment of merchant vessels as colliers, there will probably be a lack of such mechanism. At all events, some of the naval officers believe the coal could be more easily delivered from the side of a ship which suspends cruising for that operation.

Questions and Answers

All readers of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN are invited to submit questions and answers to this department. Correspondents are requested to send full name and address. This, however, will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered.

Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office not later than ten days after the date of publication of the question. Answers will be published in a subsequent issue.

QUESTIONS.

No. 10.—ELECTROMAGNET DESIGN.—What is the smallest sectional area of core of an electromagnet which will be sufficient to exercise a force of one pound upon an armature two inches away, and what winding should be used? It is to be connected to a 110-volt circuit and used intermittently.—M. E. R., Baltimore, Md.

No. 12.—"STRIP" FOR DISPLAY ILLUMINATION.—In the account of the British coronation illuminations that appeared in your issue of July 22, mention was made of the use of "strip" for outline lighting. Please explain what this "strip" material is and just how it is used.—S. J., New Orleans, La.

No. 13.—AUTOMOBILE IGNITION SPARK COIL.—Please give sketch and information on a low-tension spark coil to be used in connection with the make-and-break ignition system of a six-cylinder automobile to be operated on six volts.—S. L. K., Reading, Pa.

No. 14.—ELECTRIC LIGHTING OF PULLMAN CARS.—The Pintsch gas lighting for railway cars is to some extent being superseded by electric lighting. Please explain the *modus operandi* with reference to the electric generator and accumulators. What is average size in kilowatts of generator and accumulators? What is the efficiency of generator and accumulators? When the generator is working at its highest efficiency, speaking of one Pullman car, what impedance does same offer to the free movement of a train of passenger cars, considering continual side belt strain on axle bearings, magnetic drag weight of equipment and the like? At what speed of a train, in miles per hour, is the greatest demand of the generator on the free movement of the train, and what is the energy required in horsepower?—H. W. F., Chattanooga, Tenn.

No. 15.—TWELVE-HUNDRED-VOLT DIRECT-CURRENT RAILWAYS.—I understand that 1,200 volts is now used on a number of direct-current interurban railways. Is it possible to arrange the car wiring so that such a car may enter a city on the ordinary 600-volt trolley lines? If so, how is this done?—N. H., La Salle, Ill.

No. 17.—SINGLE-PHASE FAN MOTOR.—We have a twenty-four-inch exhaust fan driven by a one-third-horsepower, 110-volt, single-phase motor. Wind blowing down the thirty-inch duct caused the fan to act as a turbine and run backwards. When I tried to start it up again the motor just hummed, then after a few minutes it started up backwards at a very high speed. I then shut off the power. On again starting it went all right. Why did it go so fast backward the first time?—F. G. D., Lincoln, Neb.

No. 18.—CURRENT FOR ELEVATORS.—If power for lighting and elevator motors in a five-story building is to be bought, is alternating or direct current preferable, and why? With which would the motors cause most fluctuation of the lights? If there were six elevators and from 30 to 125 kilowatts of lighting, would separate generator sets be advisable?—A. B. R., Chicago, Ill.

ANSWERS.

No. 16.—OZONE AND ELECTRIC OZONIZERS.—Is the use of ozone a truly effective means of purifying the air in a large hall or theater, or is it merely an adjunct to the regular ventilating system? Is an electric ozonizer the best apparatus for preparing ozone in large quantity, such as for the service referred to?—E. K. T., Iowa City, Ia.

The undesirable physiological effects of stale air are due to the presence of waste organic matter in a more or less putrescent state. It is the intent and purpose of the "regular ventilating system" to remove this stale air and replace it with fresh air. For halls and theaters the comfort of the patrons demands that the ventilating system be of sufficient capacity to entirely remove and replace the air content of the building three or four times an hour. However, if this air be charged with ozone, the organic matter is oxidized as fast as produced, and the air content may be renewed much less frequently without discomfort, depending on the percentage of ozone initially present. This permits of a smaller capacity in the ventilating plant, it being usually designed for a complete renewal of the air every 40 or 50 minutes. There is also a marked reduction in the capacity of the heating plant required. The electrical method of ozone generation is the most commercial because of its flexibility, simplicity, low maintenance cost, the absence of dangerous chemicals, the ease with which quantity and quality may be regulated and the almost universal availability of electric energy. It is extensively used in Europe, where the problem of ozone generation has been given a much more intense and extended study than in this country. The ozonization may be accomplished either by small units distributed throughout the hall, or by a single large unit in the intake. The small units are usually equipped with an internal fan, which greatly increases their capacity by discharging the ozonized air as soon as formed and thus keeping up a constant local circulation. The large units, being located in the intake, require no separate fan, and can therefore be built much cheaper for a given capacity. The initial cost by the former method may be assumed at $7.00 per thousand cubic feet of air per hour, and of the latter at $1.00 per thousand cubic feet per hour. The former method is recommended for medium and small auditoriums where dependence is placed on "natural" ventilation. Units of capacity, from 10,000 to 20,000 cubic feet per hour, provided with internal fan and adjusting rheostats, have given excellent satisfaction in such cases at a cost much less than a "regular ventilating system."—E. N., Pittsburg, Pa.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

AMERICAN LIGHT & TRACTION.

The American Light & Traction Company's balance sheet of June 30, 1911, compares with that of June 30, 1910, as follows:

	June 30. 1911.	June 30. 1910.
	Assets.	
Investment account	$27,971,451	$28,914,818
Temporary investment	2,430,592	1,919,041
Treasury stock	*1	1
Earnings subsidiary companies	†5,029,455	3,767,870
Bills receivable	391,698	744,968
Certificates of indebtedness	602,899	171,350
Accts receivable	48,061	30,461
Mgrs., stk., cont.	170,900	189,500
Interest and dividends	40,844	14,401
Cash	1,663,655	1,563,255
Total	38,349,557	37,315,666
	Liabilities.	
Preferred stock	$14,236,200	$14,236,200
Common stock	15,000,000	15,000,000
Col. in notes		13,200
Dividends accrued	757,428	706,093
Miscellaneous	73,675	52,478
Contingency fund	966,582	966,582
Reconstruction fund	3,626,200	2,821,500
Undivided earnings	3,689,470	3,519,611
Total	38,349,557	37,315,666

*41,223 shares of common stock.
†Earnings receivable, $1,403,255; reconstruction reserve, $3,626,200.

BOSTON ELEVATED.

The annual report of the Boston Elevated, for the year ended June 30, 1911, is issued. The income account compares with the nine months ended June 30, 1910, as follows:

	1911—	1910—
Gross Inc.	$15,635,965	$11,383,686
Operat. Exp.	10,119,064	7,331,396
Net	5,516,901	4,062,290
Other Income	344,742	135,998
Total net	5,861,643	4,198,288
Chgs. & Depr.	4,511,182	3,589,342
Balance	1,350,460	608,946
Dividends	1,197,000	598,500
Surplus	153,460	10,446

AMERICAN TELEPHONE & TELEGRAPH COMPANY.

The American Telephone & Telegraph Company reports for the six months ended June 30, 1911, as follows:

	1911.	1910.
Dividends	$10,135,518	$ 9,202,326
Interest and other revenue	5,123,444	5,651,492
Telephone traffic	2,592,277	2,566,227
Real estate	46,326	49,742
Other sources	306,057	127,106
Total revenues	18,203,624	17,595,895
Expenses	1,782,461	1,694,485
Net revenue	16,421,163	15,901,410
Interest	2,805,884	2,586,355
Net income	13,555,278	13,315,055
Dividends paid	10,769,555	10,352,353
Surplus	2,785,722	2,962,701

WASHINGTON, BALTIMORE & ANNAPOLIS EARNINGS.

For the three months ended June 30 the Washington, Baltimore & Annapolis Electric Railway Company made a surplus above fixed charges of $30,924. Gross earnings increased and operating expenses decreased as compared with the period last year. For the three months the gross income was $57,899, operating expenses $84,752, and net operating revenue $98,062. Interest and taxes amounted to $67,138. Under the new capitalization there will be outstanding $4,783,000 first mortgage bonds, $1,459,887 preferred stock and $3,000,000 common stock.

MEXICAN TELEPHONE & TELEGRAPH.

The report of the Mexican Telephone & Telegraph Company for the month of May and three months ended May 31, 1911, compares as follows:

	1911.	1910.
May gross	$ 52,193	$ 45,998
Expenses	27,746	22,863
May net	24,447	23,135
Three months gross	154,639	136,111
Expenses	76,316	64,426
Three months net	78,323	71,685

STANDARD GAS & ELECTRIC.

A table of preliminary reports of earnings has been received from the following subsidiary properties of the Standard Gas & Electric Company for the year ended May 31:

	1911.	1910.
CONSUMERS' POWER CO.		
Gross	$1,378,894	$1,066,156
Net	591,909	416,848
FT. SMITH LIGHT & TRACTION CO.		
Gross	$ 493,136	$ 433,316
Net	211,272	190,822
MUSKOGEE GAS & ELECTRIC CO.		
Gross	$ 416,897	$ 320,997
Net	154,358	106,157
OTTUMWA RAILWAY & LIGHT CO.		
Gross	$ 274,913	$ 248,374
Net	128,365	115,970
ENID ELECTRIC & GAS CO.		
Gross	$ 148,209	$ 125,684
Net	66,480	50,303
EVERETT GAS CO.		
Gross	$ 96,431	$ 69,180
Net	35,788	25,044

AURORA, ELGIN & CHICAGO.

The report of the Aurora, Elgin & Chicago Railroad Company for the month of May and eleven months ended May 31 compares as follows:

	1911.	1910.
May gross	$ 152,751	$ 142,644
Expenses	89,935	82,338
May net	62,816	60,306
Charges and taxes	35,842	33,662
May surplus	26,973	26,644
Eleven months gross	1,574,293	1,444,926
Expenses	912,122	809,097
Eleven months net	662,171	635,829
Charges and taxes	380,107	340,928
Eleven months surplus	282,064	294,901

Chromax Bronze.

This bronze, (according to *Metal Industry*), is an alloy of chromium, copper, and nickel. It is the only copper alloy which contains chromium and is protected by patents. As a bearing metal it is said to be unrivalled, and it has a fusing point of 1,200 degrees Fahrenheit. It will not fuse nor cut even if raised to red heat by friction. It will stand 20,000 pounds pressure per square inch on a six-inch bearing surface at slow speed. It takes a high polish and will not crystallize. It has a tensile strength of 79,000 pounds per square inch with an elongation of 3.3 per cent and is extremely dense. It is acid proof, non-corrosive, and is not affected by sea water. It can be rolled into sheets and wire.

AMONG THE CONTRACTORS AND SUPPLY MEN

JOHN COLLINS, electrical contractor of Des Moines, Iowa, is planning to open a wholesale electrical house in that city.

L. R. JENSEN, of Aurora, Neb., has been awarded the contract for installing an electric light plant at Grafton. The contract price was $15,000.

THE J. P. KELLY ELECTRICAL COMPANY of Trenton, N. J., has received the contract for installing an electrical power plant at a cost of $1,450 for the National Radiator Company.

THE CO-OPERATIVE ELECTRIC COMPANY was recently incorporated by J. A. Mueller, Fred Schermerhorn and H. H. Schermerhorn to do a general electrical contracting and repair business at 179 Fourth Street, Milwaukee, Wis.

THE R. T. OAKES COMPANY, Holyoke, Mass., was awarded the contract for the installation of electric lights in the main auditorium of the German Lutheran Church, of that city. The contract involved an expenditure of several hundred dollars.

Western Electric Earnings.

For July the Western Electric Company's gross sales show a falling off of three per cent as compared with July, 1910, but the seven months of the current fiscal year which have elapsed are four per cent ahead of the corresponding period of last year. It now seems unlikely that the company will realize its earlier prospects of a $71,000,000 year, but the showing to date, which is at the rate of $66,000,000 for the year, is close behind the company's high record of $69,000,000 for 1906.

In the East the company's sales reports for July compare favorably with those of July, 1910, the decrease for the month coming from the central and wesetrn districts. The cable manufacturing department shows the chief decrease, the electric supplies branch shows a small gain and business in telephone apparatus being good. Inasmuch as last year the falling off in business was first noted in the East, it is not unnatural that this section of the country should show some increase this year.

Abroad the company's business is highly satisfactory.

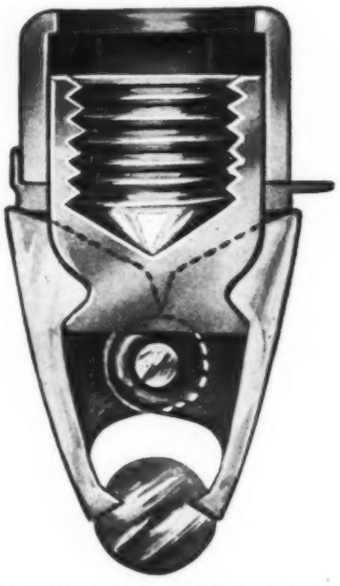
New Electrical and Mechanical Apparatus and Appliances

A New Trolley Ear.

The General Electric Company has recently placed on the market a new mechanical clamping ear, known as form M, especially designed for use on overhead construction in and around mining and industrial properties. The ear consists entirely of forgings and punchings of steel, thus eliminating entirely such imperfections and variations as are common to iron castings. This feature also permits of using small light sections of great mechanical strength, resulting in an ear giving a maximum clearance from passing trolley wheels and a minimum height from the center of the wire to the top of the clamping nut. The jaws are duplicate drop forgings, each lip fitting into the recesses of the trolley wire with absolute accuracy, insuring a grip which will have the greatest possible holding power. The jaws are hinged by a steel pin located close to the wire, and are of a length sufficient to utilize the maximum clamping effect produced by the clamping nut. The machine-steel stud jacket engages shoulders on the clamps and fits into the hexagonal interior of the clamping nut; thus by rotating the nut the stud jacket is drawn onto the suspension stud, while the nut exerts an outward pressure on the upper outer edge of the jaws which by reason of the hinge, press against the trolley wire.

The punched washer is formed around the top of the jaws to prevent its turning while the clamping nut is being tightened. It is also provided with two small lugs which may be bent up against the side of the clamping nut, effectually preventing any possibility of the ear becoming loosened in service.

The new ear is made up suitable for



CROSS SECTION OF GENERAL ELECTRIC TROLLEY EAR.

round, grooved and figure 8 wire and has either japanned or standard sherardized finish.

The form M ear, when used in connection with form H-3 suspension of the mining and ceiling type, renders possible an increase in head room of two inches to two and one-half inches.

GENERAL ELECTRIC FORM M MECHANICALLY CLAMPING TROLLEY EAR.

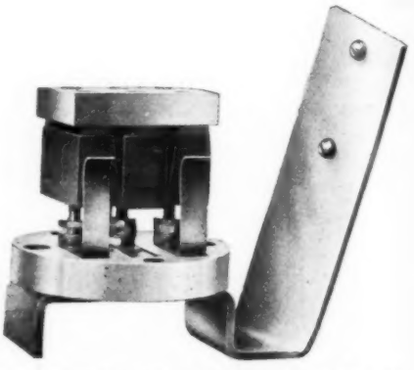
Wireless in the Wanamaker Stores.

Wireless telegraphy is more generally known on account of the services which it has rendered at sea. Little is generally known about the work which has been accomplished on land, and which in many cases is equally important as that which has been accomplished at sea.

In the August issue of the *Marconigraph* there is an illustrated article describing the Marconi wireless equipments at the Wanamaker stores in New York and Philadelphia. These stations are used for the transmission of messages received at the Wanamaker stores for ships at sea, and also for private messages between New York and Philadelphia. The service has been so satisfactory that it has been found possible to dispense with the private-wire telephone service formerly used as a means of communication between the two stores.

A Telephone Protector for Outdoor Service.

A type of open-space cutout in extensive use throughout the country today on telephone lines, both in railroad and commercial service, is the so-called No. 86 type protector, manufactured by the Western Electric Company.



TELEPHONE PROTECTOR FOR OUTDOOR SERVICE WITH COVER REMOVED.

This protector is made in two forms —one with a tin cover and the other with a cast-iron cover, known, respectively as the Nos. 86-A and 86-B. These are chained firmly to the framework of the protector mounting, so that they cannot be lost through carelessness of the lineman.

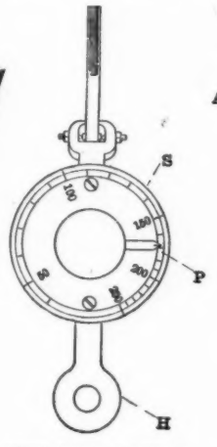
The protector itself is mounted on a porcelain base through the bottom

of which the leading-in wires are brought in, and consists of heavy carbon blocks as shown in the illustration. The spacing between these blocks regulates the voltage at which the protector operates. Under normal conditions, this is adjusted to discharge at 1,000 volts.

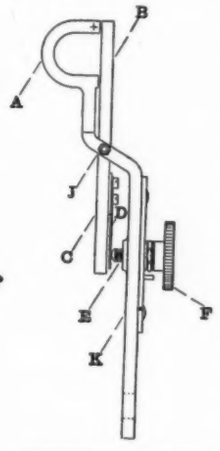
The shape of the carbon blocks gives a variable gap between the ground block and the two blocks connected to the line wire. The protectors are arranged so that carbon dust carried across by the discharge will not clog the spark gap, but will automatically drop to the bottom of the protector.

The No. 86 type protector, as is noted, is designed for use both outside and indoors, and it is arranged so that it can be mounted directly on the pole itself. In some cases, it is desirable to have a protector which can be located

TELEPHONE PROTECTOR FOR OUTDOOR SERVICE, COMPLETE.



CURRENT GAUGE—FRONT VIEW.



CURRENT GAUGE—SIDE VIEW.

in this manner outdoors, although as a general proposition, such a practice is not to be recommended on account of the additional maintenance difficulty thereby involved.

On telephone train-dispatching lines, the No. 86 type protector is being used to a considerable extent

A New Current Gauge.

Although the portable ammeter is a handy form of instrument it is apt to be expensive. On networks and large installations it is often useful to be able to ascertain the current in a particular feeder or cable under certain conditions of load. In such cases a portable instrument can only be connected in circuit with some loss of time and difficulty. Messrs. Drake & Gorham (London, Eng.) are putting on the market a portable current gauge (Frisby's patent) which need only be clipped on to a cable and a small adjusting screw turned to obtain a fairly accurate register of the amount of current passing. Details of the device are shown in the accompanying illustrations, which show plan and side views. It will be seen that it comprises a U-shaped magnet A at the end of a long arm K, and an arrangement whereby a centrally pivoted armature B can be adjusted in respect to the poles of the magnet. This consists of an adjustment screw E, which is turned by a large milled head F, there being a pointer P, under the head which moves over a disk S graduated to read in amperes. An eyelet H is provided for hanging up the gauge. In actual use the U-shaped magnet is passed round the cable, and the armature pressed against the poles to which it will adhere by reason of the attraction set up by the current passing through the cable. D is a stiff spring on the armature against which the adjustment screw rests, and this screw is turned round until the armature is forced away from the poles. When this has been done, the reading on the scale under the pointer shows the approximate current. The instrument is made at present to read up to 250 amperes.

Telephones for Baltimore & Ohio.

It is stated that the Baltimore & Ohio has ordered from the United States Electric Company forty complete station equipments for the extension of its telephone train-dispatching service from Clarksburg to Salem. This will complete the telephone dispatching of its line from Grafton to Salem, and the train-wire service is paralleled by a message service.

The Usco Air Heater.

The advantages attending the use of heated air for promoting the combustion of fuel need no insistence upon but it will probably be news to many engineers that by this means alone an economy of eighteen to twenty per cent in the fuel bill is obtainable. Practical trials have demonstrated beyond doubt the fact that the Usco air heater, manufactured by the Underfeed Stoker Company, Ltd., of London, Eng., brings about an increase in the temperature of the air to be supplied to the fire of from 150 to 450 degrees Fahrenheit, and each twenty to thirty degrees Fehrenheit increase means a coal economy of at least one per cent. The use of heated air in the furnace has a most important influence in improving the character of combustion, since it promotes chemical action and so gives a quicker re-action and a higher furnace temperature, resulting in a more energetic oxidizing effect upon those hydrocarbon gases, which, when cold air is used, are difficult to consume, and result in smoky combustion. When using heated air the flame is bright and clear, and almost smokeless, and with inferior fuels, and those containing much moisture, this effect is still more pronounced.

The use of heated air is also attended with the further advantage that, just in proportion as its temperature is raised, heat losses due to an excess of air passing through the fire are diminished, that is, if the air entered the fire at the temperature of the escaping gases there would be no loss due to any excess employed over that required for actual chemical combination with the fuel. This is an important point, for, while a pound of carbon in coal requires theoretically only about twelve pounds of air for its combustion, it is found in practice that to insure the proper burning of coal without the formation of incomplete products of combustion, viz., CO and hydrocarbons, not less than twenty pounds of air are required. All this excess of surplus air has of necessity to be raised to the furnace temperature. The manufacturers claim for the "Usco" an efficiency per unit of area of exterior heating surface greatly in excess of any other air heater. They point out that radiant heat passes through a dry colorless gas without effect in raising its temperature, and while the metallic chambers, through which the air to be heated is passed, may be very hot indeed, the

temperature of the issuing air has hitherto been so low as to appear out of all proportion to the temperature of the walls of the heater and the gaseous medium in which the heater is immersed. Heating of such a gas can only be effected by bringing its molecules into actual contact with a heated surface.

It is maintained that manufacturers of air heaters have heretofore relied upon the expectation that radiant heat would substantially assist the heating of the air, and have not given adequate attention to the necessity of obtaining the maximum of surface contact. In the Usco heater this necessity has been exemplified to the greatest possible extent by not only constructing the apparatus so that as a container of the air to be heated it exposes the maximum surface to the molecular contact of the air, but in addition to this, metallic diaphragms, or radiation plates, are inserted in the air spaces parallel to their walls midway between them. These radiation plates become highly heated by the radiant heat from the walls of the heater on either side of them, and there is thus furnished approximately double the heated contact surface, greatly increasing the heating effect of the apparatus In addition to the other mechanically novel features of the Usco air heater, this thermal diaphragm constitutes an innovation of the greatest practical importance, and is one which has been recognized by the German and other patent offices by the granting of very broad and liberal patents.

Wireless on a Sailing Ship.

An interesting example of the use of wireless telegraphy on a sailing ship is furnished by the equipment of the cadet ship *Mersey*, belonging to the White Star Line, which recently arrived in the Thames River after a voyage around the world. The installation is unique, inasmuch as it is claimed to be the first instance of a sailing vessel carrying a wireless equipment, and the fact that the apparatus on the *Mersey* worked for eleven months without a single breakdown, notwithstanding the fact that none of the men on board had had any practical experience with wireless telegraphy, is an acknowledged tribute to the efficiency of the Marconi system.—*Marconigraph.*

New Westinghouse Direct-Current Motor.

The Westinghouse Electric & Manufacturing Company has announced a new direct-current motor for general power service. This motor, which is called type SK, has a number of novel features and represents in many respects the most advanced design in direct-current machines.

One of the strongest features of this new motor is its excellent commutation, which is obtained partly by the use of the commutating poles and, partly, by the careful design of the commutator brushes and brush holders. Practical service tests have shown practically sparkless commutation under all conditions of speed or load up to extreme overloads. Another characteristic of importance is the large dust-proof bearings, and the efficiency of the oiling systems. Large oil rings keep the bearing surface well lubricated whenever the motor is in operation, but the oil cannot leak or be thrown out of the oil well.

As can be seen from the accompanying illustration, the motor is very simple in construction. The frame is of a new design. It is a ring of open-hearth steel made by hot-rolling the slab into shape and welding the ends together. Rolled steel is an ideal material for motor frames because of its high magnetic permeability, uniform structure, and great strength.

The feet are pressed from steel plate and are riveted under great pressure, making a very rigid construction.

The armature is so wound that wide spaces are left between the ends of the coils, and ventilating ducts are provided in the core, an arrangement that assures ample ventilation. The coils are form wound, laid in open slots and held by fiber wedges and bands. The shaft can be pressed out without disturbing the aramature windings and commutator connections.

NEW DIRECT-CURRENT MOTOR.

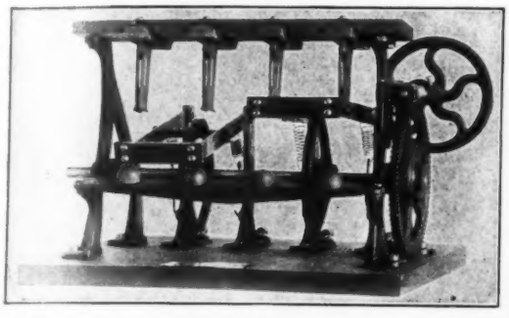
These motors are made for 115, 230 and 550 volts in capacities of from 1.5 to 50 horsepower.

The speed correspond closely to the full-load speed of induction motors, thus simplyfying the application of motors and making changes from motors of one class to those of another comparatively easy.

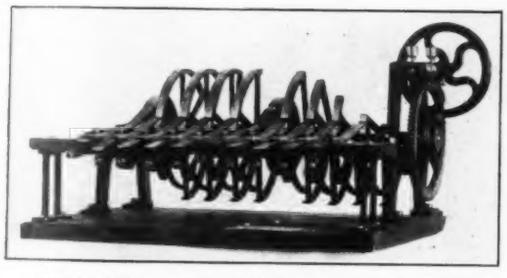
Out of the twenty-seven countries which signed the international wireless-telegraph agreement of November 3, 1906, twenty have already ratified it.

New Types of Flashers.

The illustrations herewith show two new types of flashers recently placed on the market by the Reynolds Dull Flasher Company, of Chicago. One is the knife type, with metal contacts, intended to fill the demand of the trade for a cheaper article than the Dull carbon machine. It is a thoroughly serviceable and reliable machine, and is mounted on a three-fourths-inch slate base, heavy construction throughout, with steel worm and machine-cut gear. All parts are readily accessible and interchangeable throughout. These flashers require no other attention than oiling once a week and keeping the contacts clean, and they are made in fifteen-ampere sizes only, that is, double-pole, capacity fifteen amperes per switch.



NEW KNIFE-TYPE ELECTRIC SIGN FLASHER.



NEW BRUSH-TYPE ELECTRIC SIGN FLASHER.

The other type shown is the brush type intended to supply the demand for a cheaper machine than the Dull single pole. The cams, constituting a drum on this machine, are the heaviest used on any similar device, and the brushes are of pure copper, eight leaves thick and provided with a special brush holder that entirely prevents a loose contact and abnormal burning. Their capacity is five amperes per switch. They require no more attention than the knife type described above. Both types are guaranteed against defective material.

New Twelve-Story Office Building for H. W. Johns-Manville Company.

The accompanying photograph shows the new twelve-story office building now being erected on the Southwest corner of Forty-first Street and Madison Avenue, New York City, for the H. W. Johns-Manville Company, who will occupy it in its entirety about May 1, 1912, as the general offices and New York salesrooms of the concern.

It was the desire of the owners to have a distinctive building, and the early Italian Gothic architecture was selected. This style of architectural treatment has not heretofore been employed for buildings of this character, and in this respect the edifice will be unique.

NEW OFFICE BUILDING OF H. W. JOHNS-MANVILLE COMPANY.

There will be a mezzanine gallery with bronze rails and a marble stairway, with bronze railing, leading up from the first to the second floor. Each floor will be devoted to one or more departments. The executive offices will occupy the eleventh floor, while the twelfth floor will be used as a sample and exhibition room.

The building has been designed so that all four sides will be attractive. It will be known as the Johns-Manville Building, and will have the unique distinction of being one of the few twelve-story structures to be entirely occupied by a manufacturing concern for office purposes only.

The building will be of fire-proof steel construction throughout, and will contain two Otis passenger elevators of the latest type. Each floor will have an area of 2,500 square feet, or a total area for the twelve floors and basement, which will extend under the sidewalks, of 34,500 square feet.

An unusual feature connected with this building will be the fact that the tenant manufacturers will furnish a considerable part of the equipment of the structure. Among the various materials which the H. W. Johns-Manville Company will install will be the following: J-M asbestos roofing, J-M asbestos plaster, J-M Linolite system of lighting, J-M conduit for wiring, flushometers, J-M Sanitor seats, electrical accessories, waterproofing, Keystone hair insulator, J-M asbestos wood, fire extinguishers, J-M Asbesto-Sponge felted and J-M Asbestocel pipe coverings, etc.

Fire-proof materials will be used throughout the structure. Modern systems of heating and ventilating will be employed, and the building will rank, architecturally and otherwise, among the handsomest and most substantial office structures in New York.

This is but one of a chain of branch stores, warehouses, offices, and factories scattered throughout the United States and Canada, which are under the supervision of the executive officers of the company, whose headquarters will be in this new building.

Toledo & Ohio Central Installs Telephone Train Dispatching.

The Toledo & Ohio Central Railroad has ordered forty-eight Western Electric telephone selector equipments for use on its eastern division. There will be two circuits equipped, one extending from Bucyrus to Toledo, a distance of seventy miles, and the other from Bucyrus to Thurston, a distance of seventy-eight miles. The telephone messages will be sent over a line wire of No. 9 B. & S. copper, and the dispatchers for both circuits will be located at Bucyrus.

Device for Measuring Volume.

Prof. Theodore Richards has employed a method of electrical contacts for measuring volumes very accurately. As the mercury is adjustable, it can be set to just make or break an electrical contact consisting of a fine platinum point. He has used the method to determine differences in the compressibilities of liquid.

A New Automatic Fire-Alarm Device.

An automatic fire-alarm device has recently been invented by John Frederick Nelson and Charles D. Lindridge, of Providence, R. I., which is constructed along novel lines. A porous cup is sealed over a flexible diaphragm which is free to move inward, or, in other words, in the direction toward the porous cup. Platinum contact points are associated with the diaphragm and arranged to change the electrical conditions of the alarm circuit to which the device is connected upon a movement of the diaphragm. The device is provided with a suitable casing which allows air to circulate freely around the porous cup.

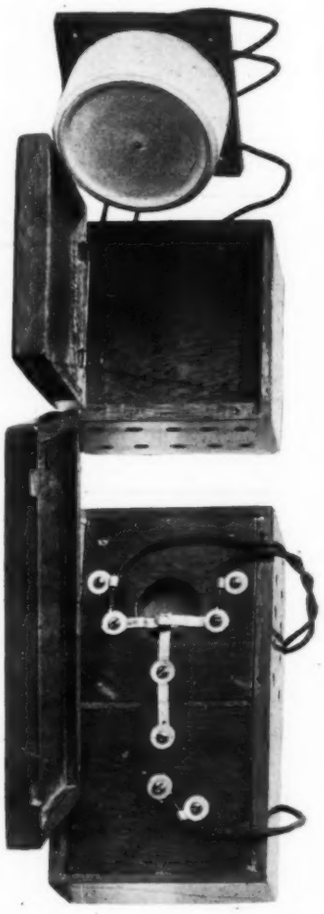
The operation of the device is as follows: Immediately a small conflagration starts up a considerable amount of oxygen is at once burned, leaving a volume of vitiated air. This vitiated air, being heated, rapidly rises to the ceiling, where it strikes the alarm device and surrounds the porous cup. A quantity of the pure air inside the cup then passes through the cup and diffuses with the vitiated air outside, leaving a reduced atmospheric pressure within the cup which results in a movement of the diaphragm. This movement of the diaphragm takes place almost instantly. To demonstrate the quickness of the device a lighted match may be held a few inches below it, which results in an alarm being sent in within four seconds. When the condition of the air again becomes normal the device automatically restores itself.

The principle of the diffusion of gases through a porous element which is utilized in this device was discovered by Thomas Graham in the early part of the last century, and fire-damp detectors for use in mines, utilizing the opposite action of an increased atmospheric pressure within the porous element have been patented. A fire-damp detector recently invented by two junior teachers of the Technical College at Sydney, Australia, is also described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of July 29, 1911. In this device plaster of Paris is used for the porous element and an increased atmospheric pressure set up within it moves a column of mercury in a tube. This movement of the column of mercury is caused to operate an alarm.

The automatic fire alarm, as would naturally be expected, finds its greatest field of usefulness in factories and warehouses, a large number of such buildings being at present equipped with thermostats connecting direct to a central station. The porous-cup type of automatite fire-alarm device described above, when suitably encased, is said to form a very quick and reliable "thermostat" for this use. In addition to this, however, a field exists for private automatic fire-alarm systems for residences. A fire starting up in any part of a house so equipped, and which is not entirely unoccupied at the time, is instantly detected, with the result that it is probably put out by hand, whereas, with perhaps only two more minutes' headway, it would have been necessary to have sent in an alarm to the fire department. A porous-cup type of alarm device constructed for this use is shown in Fig. 1 suspended from the moulding of a room. This device is equipped with a loud-sounding buzzer which, in addition to a bell centrally located in the hallway, sounds when the device is operated. The particular device shown in the photograph is provided with an additional contact associated with the diaphragm and, in addition to giving an alarm upon the presence of fire, gives a local alarm by sounding the buzzer only upon the presence of unburnt illuminating gas. The unburnt illuminating gas has the action of setting up an increased atmospheric pressure within the porous cup. This gas-alarm feature is of particular value, owing to the greater danger of asphyxiation and explosions, in rooms where electric gas lighting is installed.

AUTOMATIC FIRE ALARM INSTALLED IN ROOM.

After once being placed in thorough working order in a residence the alarm devices should require no further attention. Under no ordinary circumstances, however, should the fire-alarm system be provided with a separate battery, for if this is provided there is great danger of the battery being run down and the system thereby rendered inoperative, just at a time when its operation is required. For this reason the fire-alarm system should be connected with a battery in constant use.



AUTOMATIC FIRE-ALARM DEVICE.

This can conveniently be done by connecting with the door-bell battery and using a somewhat higher-voltage bell for the door-bell than is used for the fire-alarm bell.

Canadian Firms Unite.

The Canadian Fairbanks Company, with head offices in Montreal and branches throughout the Dominion, and the Fairbanks-Morse Canadian Manufacturing Company, Ltd., with head offices in Toronto, and its subsidiary companies, the Dominion Safe & Vault Company, Ltd., of Tarnham, Que., and the E. & T. Fairbanks Company, of Sherbrooke, have united.

Current Electrical News

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

The Public Service Commission, Second District, has received applications from the Mohawk Hydro Electric Company and the Fort Plain Gas & Electric Company for consent to a contract leasing the portion of the Fort Plain Company's distribution system situated in the village of Nelliston to the Mohawk Hydro Electric Company. The Fort Plain Company is now receiving power from the Fulton Gas & Electric Company and purposes to change its source of supply to the Mohawk Hydro Electric Company. Under the new contract with the Mohawk Hydro Electric Company it is stated that the Fort Plain Company will be in position to render better service and to increase its opportunities for enlarging its business and prevent future interruptions to its service such as have occurred in the past. The Mohawk Hydro Electric Company has also asked the Commission to begin construction and operate a transmission system for the supplying of electricity for light, heat and power purposes in the towns of Ephratah and Palatine and the village of Nelliston under franchises granted by these municipalities.

The Mohawk Hydro Electric Company has also asked for authority to issue its six per cent thirty-year gold bonds to the amount of $56,000 for construction of a substation and a transmission line from its power station in the village of Ephratah to the villages of Nelliston and Fort Plain.

The Public Service Commission, Second District, has authorized the Hornell Electric Company to issue capital stock to the amount of $138,000, the proceeds to be used for various improvements and extensions to the company's plant at Hornell, Steuben county.

The Public Service Commission, Second District, has authorized the Rockland Light & Power Company to issue $100,000 five-per-cent bonds to be sold for not less than ninety-three and the proceeds to be used for extensions and improvements to its plant. The company operates in Nyack and a number of other villages in Rockland County.

The Public Service Commission, Second District, has authorized the Niagara Light, Heat & Power Company to issue and sell $20,000 of five-per-cent bonds payable under the terms of the mortgage on May 1, 1925, the bonds to be sold at not less than eighty-five and the proceeds used for the laying of gas mains in various streets in the city of North Tonawanda .

The final order of reduction in the interborough rates of the New York Telephone Company in Greater New York was entered on August 10 by the up-state Public Service Commission. The order of the Commission made on June 1, which carried reductions of from ten to five cents for messages between Manhattan and Brooklyn and between Manhattan and central station districts, Astoria and Newton on Long Island, and reductions of from fifteen to ten cents between Manhattan and central station districts in Flushing, Richmond Hill and Jamaica on Long Island, stands with the exception of some modifications in the district covered on the outskirts of Brooklyn and Long Island. The Manhattan up-town dividing line is One Hundred and Tenth Street, west, and One Hundred and Third Street, east. The company is given until December 1 next to put the reduced rates into effect in order that it may have sufficient time to make additions to its plant and equipment which the increased service following the reduced rates is expected to demand.

The company has agreed to the terms of the order as now made and will on the date given make the reductions required by the order.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

PLANS FOR CALIFORNIA POWER.—Plans have been prepared oy the Pacific Gas & Electric Company to develop an additional 71,000 hydroelectric horsepower at a cost of about $10,000,000. The additional capacity will bring the company's total horsepower up to 260,000, including steam plants of over 96,000 horsepower. The company now serves about 33,000 square miles in Central California and has about 1,100 miles of high transmission lines. The plans provide for the erection of a dam in the canyon of the South Yuba River, which will increase the present water storage from fifteen lakes in Nevada and Placer counties by 2,500,000,000 cubic feet. Two plants will be constructed. The first, having a head of 1,647 feet, will develop 50,000 horsepower; the second, which will use the water again, will have a fall of 750 feet with a capacity of 21,000 horsepower.

The resultant overflow of water is then used for irrigation purposes, and additional acreage is being developed in Placer County for fruit-growing purposes.

LIGHTING AND POWER.

(Special Correspondence.)

WASHBURN, WIS.—The city is installing equipment for street lighting. C.

JACKSON, CAL.—The South Amador mine will build a new transformer house. A.

MAYNARD, MINN.—There is an agitation for the installation of an electric light plant. C.

FRISCO, ARIZ.—D. M. Potter has plans for the erection of a power plant on the Gila River.

POCAHONTAS, IOWA.—This city is about to vote on bonds for $14,000 for an electric light plant.

GARDEN CITY, KANS.—A bond issue of $40,000 has been voted to establish an electric light plant here.

PINE BLUFF, ARK.—The Pine Bluff Corporation will double the capacity of its electric light plant.

NESS CITY, KANS.—Bonds for $16,000 are soon to be voted on here, to construct an electric light plant.

POPLAR GROVE, ILL.—Warren Webster is installing an electric light plant and will sell light and power. Z.

MENARD, TEX.—E. C. Clark, of Chicago, contemplates the establishment of an electric light plant here.

PASCO, WASH.—A conduit system for ornamental cluster lighting in the business district is being installed. A.

EXCELSIOR, MINN.—The Belle Plaine Lighting & Power Company has begun the construction of its plant.

WINTERS, CAL.—The local Citizens' Committee contemplates the installation of a lighting system at Winters Lake. A.

SIOUX FALLS, S. D.—The Sioux Falls Light & Power Company has been sold to H. M. Byllesby & Company, of Chicago. C.

BRYAN, TEX.—An election is to be held here August 21 to vote on electric light and waterworks bonds for $20,000.

EUGENE, ORE.—This city has voted bonds for $57,000 for extensions and improvements in the municipal electric plant. A.

OAKLAND, CAL.—The Pacific Gas & Electric Company has taken out a permit to build an addition to its plant. The cost will be $40,000. A.

INGLEWOOD, CAL.—The Southern California Edison Company has entered into contract to install a street-lighting system in this city. A.

COLTON, CAL.—The Southern California Edison Company has had plans prepared for a new power plant at M and Eleventh Streets. A.

GREENVIEW, ILL.—The Greenview Electric Light & Power Company is building a transmission line to supply current to rural patrons. Z.

AZUSA, CAL.—The Pacific Light & Power Company will build a power line from its plant here up the San Gabriel Canyon, twenty-two miles.

LEWISTON, IDAHO.—The Pacific Light & Power Company is perfecting plans to extend its system from Walla Walla to Clarkston.

GRANDVIEW, WASH.—The Pacific Light & Power Company has been awarded a franchise for an electric light and power line in this city.

RED WING, MINN.—The Minnesota-Wisconsin Power Company, of Menominee, Wis., will construct a 66,000-volt power line to Wabasha. C.

KINGMAN, ARIZ.—The Northern Arizona Gas Company will build a new gas plant here. The company maintains offices at Los Angeles, Cal. A.

GREAT FALLS, MONT.—Conduits for wires for electric light lamp posts will be installed by the Great Falls Electric properties at a cost of $1,500. C.

VALLEJO, CAL.—The Pacific Portland Cement Company plans for extension in its transmission system in this county. A franchise has been asked. A.

REVELSTOKE, B. C.—The contract for the second flume at the power plant was awarded to the Pacific Coast Pipe Company, of Vancouver, at $7,425. C.

PORTLAND, ORE.—The Mt. Hood Railway & Power Company has had plans prepared for a new generating station to be erected near Williams Avenue. A.

BEDFORD, IND.—The Merchants' Association of this city is planning to install a new five-cluster lighting system in the busi-

ness center of the city. Iron posts thirteen feet high and ornamented will be used. S.

ELKO, NEV.—The Jarbridge Power Company has been incorporated for $100,000 by Gilmore Kenney, Jr., J. M. Kinney, J. T. Brunn and Geo. F. Elliott.

SAN FRANCISCO, CAL.—The Mill Valley Gas & Electric Company has been incorporated by L. E. Burks and F. L. Fenton with a capital stock of $100,000. A.

BOISE, IDAHO.—Oregon Light & Power Company has been awarded a seven-years' contract for furnishing the city of Boise, Idaho, with light and power.

RENO, NEV.—The Nevada Power & Transportation Company has commenced surveys for its new power plant, of 5,000-horsepower, on the Truckee River. A.

WAUKEGAN, ILL.—The magnetite system of street lighting will be used in the city, supplanting the arcs. The North Shore Electric Company will supply the current. Z.

PERU, IND.—The electric light plant being built by Godlove Conradt for the city at a cost of $60,000 is almost completed and will be put in operation in a short time. S.

OROVILLE, CAL.—The Oro Water, Light & Power Company will install a conduit system for its lines. The local telephone company will also place its wires underground. A.

TEXARKANA, ARK.—The Texarkana Gas & Electric Company will make a large bond issue, the proceeds to be expended for new machinery and equipment.

OGDEN, UTAH.—The Davis & Weber Counties Canal Company will soon commence construction on its proposed power plant. H. A. Strauss will be in charge of this work. A.

BATAVIA, ILL.—The Aurora, Elgin & Chicago Railway will supply electric power for the United States Wind, Engine & Pump Company, which is abandoning water power. Z.

FAIRBURY, ILL.—The Fairbury Electric Light Company is installing a new 300-horsepower boiler but later will install another and otherwise enlarge the capacity of the plant. Z.

INDEPENDENCE, IOWA.—The contract for new equipment for the electric light and power plant, approximating $11,000, was awarded to the Allis-Chalmers Company, of Milwaukee. C.

BEARDSTOWN, ILL.—The Beardstown Electric Light & Power Company secured the contract to furnish the current which will drive the machinery at the S. L. Von Fossen Marble Works. Z.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has had plans prepared for a new 71,000-horsepower hydroelectric plant on the South Yuba River. The estimated cost is approximately $10,000,000. A.

CLINTON, IND.—The Clinton Electric Light & Power Company has increased its capital stock from $10,000 to $40,000. The company proposes to improve the plant and add some new machinery. S.

NEW LISBON, WIS.—Bids for the erection of the electric light plant and water works plant were rejected and new bids will be opened at 1:30 p. m., August 23. W. S. Sargent is city clerk. C.

GRASS VALLEY, CAL.—The Northern Water & Power Company contemplates the erection of three hydroelectric plants near Washington and Bridgeport with a total capacity of 175,000 horsepower. A.

PORTLAND, ORE.—The Northwestern Electric Company has selected a site on the Klickitat river, near Lyle, Wash. for its proposed 8,000-horse power generating plant. The estimated cost is $100,000. A.

EATON, IND.—This town is lighted with electricity for the first time in its history. The current is furnished by the Muncie Electric Light Company, which is stringing lines on all the surrounding towns. S.

FOND DU LAC, WIS.—The Eastern Wisconsin Railway & Light Company will erect a brick addition to its plant at North Main and Rees Streets. A new stoking apparatus will be installed. The cost will be $20,000. C.

NEWARK, N. J.—An estimate made by the Water and Street Lighting Committee places the saving made in a year by the installation of a municipal lighting plant, at $6,616. There are 401 arc lamps now in use.

LOS ANGELES, CAL.—A complete power and generating plant will be installed in the new hotel to be erected at Beverly Hills by the Rodeo Land & Water Company. Plans are being prepared by Elmer Grey, Los Angeles. A.

BLYTHE, CAL.—The Chuckawalla Development Company has filed a water claim of 300,000 inches in the Colorado River, at Riverside, Cal. A large power plant is to be constructed at Bullshead, near Fort Mojave, Ariz. A.

LOS ANGELES, CAL.—A power plant will be installed in the new hospital to be erected on Washington Street by the Francis Willard Hospital Association. The estimated cost is $100,000. Dennis & Farwell are the architects. A.

SPOKANE, WASH.—The Pacific Light & Power Company is planning the construction of a 1,000,000-horsepower hydroelectric installation in the Columbia River at Priest Rapids, southwest of town. to cost $8,000,000 to $10,000,000. Eight years will be required to complete the work. C.

TAYLORVILLE, ILL.—The Taylorville Gas & Electric Company will expend between $75,000 and $100,000 in remodeling its plant, it is reported. John W. Morrison of Lincoln, Ill., has the contract for the construction work. Z.

BROWNS VALLEY, MINN.—The contract for the installation of the electric light plant has been awarded to the Minneapolis Steel & Machinery Company, Minneapolis, at $10,950. Charles L. Pillsbury, of Minneapolis, is the engineer. C.

PHILADELPHIA, PA.—An appropriation of $30,000 has been made providing for the installation of new lights and maintaining them during the remainder of the year. It is expected that 750 new lamps will be installed by September 1.

YREKA, CAL.—The Siskiyou Light & Power Company is surveying for its new transmission line between here and Klamath Falls, Ore., by way of Dorris. The new power plant on the Klamath River is now in course of construction. A.

SEDRO-WOOLEY, WASH.—A complete isolated power and generating plant will be erected in connection with the new Northern Hospital. Contract for the buildings has been let at $115,000. The State Board of Control, Olympia, is in charge. A.

COUNCIL BLUFFS, IOWA.—The contract for lighting arrangement for the carnival the first week in September, involving the placing of approximately 3,500 incandescent, sixteen-candlepower lamps, was let to the Damon Electric Company. C.

ASHLAND, ORE.—The City Council has passed an ordinance repealing its grant of franchise to the Ashland Electric Power & Lighting Company and ordering the removal of the property before October 15. The city plans to operate its own lighting plant. A.

INDIANAPOLIS, IND.—The Board of Public Works has ordered all public-service corporations to place their wires underground within the mile square by September 1. This order applies to all wire companies except the City Railway Company's trolley wires. S.

OROVILLE, CAL.—The Great Western Power Company plans for the erection of three new power plants on the Feather River; at Butte Creek, Mosquito Creek and Bartee's Bar. The total capacity will be about 300,000-horsepower and the estimated cost $18,000,000. A.

CANBY, MINN.—A party of South St. Paul business men including E. W. Erick, M. O'Toole and Fred Schult has secured a franchise to operate an electric light, heat and power plant here, and plans are made to have the system established this summer and put in operation next winter.

KENDALLVILLE, IND.—The City Council has under consideration either an enlarged city lighting plant or the securing of current from the Toledo & Chicago Interurban Company for light and power. The Interurban Company has agreed to furnish the current at a flat rate of 2.25 cents per kilowatt-hour delivered at the plant. S.

ELKHART, IND.—The Indiana & Michigan Electric Company is preparing to make improvements to the company's dam and hydraulic plant estimated to cost $500,000. The work will be under the control of G. H. Knutson, an engineer in the employ of the Knuston Engineering Company, of Jackson, Mich. Work is to be begun soon. S.

AUGUSTA, ME.—The Des Moines River Power Company, with an authorized stock of $500,000, Portland, has been chartered to develop power sites on the Des Moines River in Iowa or elsewhere, to sell electricity for light or power, and to control and operate enterprises using power. The president is Clarence E. Eaton and the treasurer, T. L. Croteau.

BAKER CITY, ORE.—Mainland Bros. have completed the capitalization for the $4,000,000 Ox Bow project. A million and a half has already been spent in tunneling through the Ox Bow curve and two million and a half will be required to complete the work. A large dam will be constructed and the foundation for the power plant has already been placed.

PITTSBURG, PA.—The syndicate formed by Van Horn Ely has sold the light and power plants and franchises in McDonald, Oakdale, Cannonsburg, Washington, Waynesburg and intermediate points in Pennsylvania, lately acquired by the Ely syndicate to the J. S. & W. S. Kuhn corporation of Pittsburg. The deal involves properties estimated to be worth nearly $2,000,000.

OAXACA, MEX.—Jose Vasconcelos, of Mexico City, representing a syndicate of Americans, has applied to the City Council of Oaxaca for a franchise to install an electric light and power plant. It is the announced purpose of the syndicate to construct transmission lines to many of the towns and mining camps of the state and provide them and various industries with electrical energy.

PORTLAND, ORE.—The Pacific Power & Light Company plans for the erection of a large hydroelectric plant on the Columbia River, near White Bluffs, Wash., and an extensive transmission system will be constructed. The estimated cost is $6,000,000. The company will install a lighting and power service at Grandview, Wash., where a fifty-year franchise has been granted. A transmission system will be constructed from The Dalles to Mosier, Ore

ELECTRIC RAILWAYS.

(Special Correspondence.)

SANTA MONICA, CAL.—The Los Angeles-Pacific Railway will extend its lines from this city to Ocean Park. A.

MARENGO, ILL.—The Woodstock & Sycamore Traction Company has been granted a franchise to construct and operate a railroad in the city. Z.

SOUTH ST. PAUL, MINN.—The Interurban Construction Company, Hastings, Minn., is about to commence the construction of the interurban line to Hastings. C.

GREENVILLE, TEX.—The Mineral Heights Traction Company is constructing an interurban electric railway between Greenville and Mineral Heights, three miles. D.

SEATTLE, WASH.—The city plans for the construction of an electric railway from Raglan Station to Cedar Lake, about three miles. Cost estimated at $50,000. A.

BROWNSVILLE, TEX.—The St. Louis, Brownsville & Mexico Railway will construct a motor car line through Brownsville to connect the depot of that road with that of the Rio Grande Railway. D.

SAN JOSE, CAL.—The San Jose & Santa Clara County Railroad Company has made application for a thirty-year franchise for a standard-gauge electric railroad along The Alameda; also for a franchise on Fourteenth Street, San Jose, Cal.

HASTINGS, NEB.—The Northwestern railroad has adopted the telephone method of dispatching trains, all running between Missouri Valley, Ia., and Fremont. It is expected that ultimately the new system will be extended on the branch line to Hastings.

MERCED, CAL.—The survey of the Tidewater & Southern Electric Railroad, now being built between Stockton and Merced, has reached the city limits. Branch lines are to be run to Livingston, Creasy, Yam and Winton, also to Newman on the west side of the San Joaquin River.

KOKOMO, IND.—A. J. Yawger & Company, contractors, of Indianapolis, Ind., have been awarded the contract for the grading, building, tracklaying and ballasting of the Kokomo, Frankfort & Western Traction Company line from Kokomo to Frankfort. The work was begun August 2. The company has headquarters at Forest. The total length of the line is twenty-six miles. S.

PARIS, TEX.—The Board of Trade of Paris is giving its official support to the proposed interurban electric railway that is to be constructed between this place and Sherman, Tex. The sum of $10,000 has been subscribed towards a total fund of $30,000 to pay the cost of the preliminary survey. The people of Sherman have subscribed $10,000 and the remaining $10,000 is being raised along the route. D.

SPRINGFIELD, ILL.—The organization of the Springfield & Northwestern Interurban Railway Company, which proposes to build an electric line from Springfield to Petersburg, has been perfected here. The company organized with $15,000 capital stock. The following were elected directors: Homer J. Tice, Greenview; R. Y. Kincaid, Athens; E. D. Keys, W. F. Workman, Ralph N. Baker, Frank Reisch, Jr., and S. E. Prather, Springfield. Surveys of the new line have already been made and a portion of the right-of-way obtained. The route of the road passes through Andrew, Cantrall, Athens, Tice, Old Salem and Petersburg.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

MOTT, N. D.—The North Dakota Independent Telephone Company is building a line to Bismarck. C.

HARVEL, ILL.—The Montgomery County Telephone Company contemplates establishing an exchange here. Z.

MARSHFIELD, WIS.—The Marshfield Telephone Company has been incorporated with a capital stock of $50,000.

ALBERT LEA, MINN.—The Northwestern Telephone Exchange Company will expend $10,000 in improvements to its plant. C.

CLINTON, MINN.—The Minnesota Central Telephone Company is erecting a new central building and installing a new switchboard and other improvements. C.

SAN BERNARDINO, CAL.—The California-Nevada Power Company has been granted a franchise in this county. The sum of $150 was paid for same. A.

SPOKANE, WASH.—The Pacific Telephone & Telegraph Company has awarded the contract for its new 8-story exchange and office building to H. J. Skinner; price, $98,000. A.

YORKVILLE, ILL.—The Chicago Telephone Company is rebuilding its line between this city and Bristol Station, eliminating one pole line. Two pole lines have been in use. Z.

ORANGE, MASS.—The New England Telephone Company is expending $3,500 in additional facilities in order to be prepared when the new rates go into effect on October 1. The greater port of the expenditure is for cable work.

LINDEN, ALA.—The Linden & Nanafalia Telephone Company, with an authorized capital stock of $2,000, half of which is paid in, has filed its certificate of incorporation. Its incorporators are A. L. Hasty, W. C. Dozier and B. F. Gilder.

ELECTRICAL SECURITIES.

The Chicago & Oak Park Elevated minority stockholders have formed a protective committee consisting of Albert C. Perrill, Theodore W. Smith, Alfred Cohn, Cory E. Robinson and William Dougall to negotiate settlement with Chicago Elevated Railways.

Stockholders of the Northwestern Elevated Railroad met on August 10 and reorganized under the new management. Britton I. Budd was elected president to succeed Mason B. Starring. Samuel Insull was made chairman of the board of directors. All but three of the old members retired and the following board was elected: Samuel Insull, Britton I. Budd, William A. Fox, Henry A. Blair, W. V. Griffin, Mason B. Starring, Samuel McRoberts, John H. Gulick and Ira M. Cobe. Messrs. Insull, Blair, Cobe, and McRoberts are four of the seven members of the board of governors of the Chicago Elevated Railways.

DIVIDENDS.

A quarterly dividend of one and one-half per cent has been declared by the Philadelphia Electric Company, payable August 15.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.

	Aug. 14.	Aug. 7.
Allis-Chalmers common	6¾	8
Allis-Chalmers preferred	21	28¼
Amalgamated Copper	61½	63½
Amer. Tel. & Cable	78⅜	78⅜
American Tel. & Tel	134	135¼
Brooklyn Rapid Transit	74¾	77¾
General Electric		154½
Interborough-Metropolitan common	16	16⅝
Interborough-Metropolitan preferred	42¾	45
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	83½	86
Mackay Companies (Postal Telegraph and Cables) preferred	74	74
Manhattan Elevated	74	74
Metropolitan Street Railway	18	18
New York & New Jersey Telephone	103	103
Pacific Tel. & Tel	38½	47
U. S. Steel common	72⅝	47⅜
U. S. Steel preferred	115⅝	117
Western Union	73½	76
Westinghouse common	65⅜	67
Westinghouse preferred	118¼	118¼

*Last price quoted.

BOSTON.

	Aug. 14.	Aug. 7.
American Tel. and Tel	134	135¼
Edison Electric Illuminating	287	287
General Electric	152	155½
Massachusetts Electric common	20	21½
Massachusetts Electric preferred	90¼	147½
New England Telephone	149	149
Western Tel. & Tel. common	19	20
Western Tel. & Tel. prefererd	96½	99

PHILADELPHIA.

	Aug. 14.	Aug. 7.
American Railways	44½	44½
Electric Company of America	10⅞	12
Electric Storage Battery common	52	53⅛
Electric Storage Battery preferred	55	55
Philadelphia Electric	17½	17⅝
Philadelphia Rapid Transit	22⅝	23½
Philadelphia Traction	86½	86½
Union Traction	50½	38½

CHICAGO.

	Aug. 14.	Aug. 7.
Chicago Elevated common	25	27
Chicago Elevated preferred	90	90
Chicago Railways, Series 1	95	95
Chicago Railways, Series 2	29½	31½
Chicago Subway	2¾	3¼
Chicago Telephone	123	123
Commonwealth Edison	131	135
National Carbon common	111	111
National Carbon preferred	117	117

PERSONAL MENTION.

F. W. ADAMS, general manager of the Toledo, Fostoria & Findlay interurban line, has tendered his resignation, to take effect as soon as accepted. Mr. Adams has been with the company since its organization.

B. J. ARNOLD, who has been engaged by the City of Los Angeles, Cal., to investigate the proposed municipal electric railway from the city to the harbor, will soon present his report to the Municipal Transportation Committee of that city.

F. B. DE GRESS, for over ten years New York district manager of the Crocker-Wheeler Company, has resigned from that Company to assume the position of general sales manager of the Pulsometer Company, 17 Battery Place, New York City.

H. VANCE LANE, formerly president of the Rocky Mountain Bell Telephone Company, has, with the consolidation of the Bell Telephone Companies of Utah, Idaho, Colorado and New Mexico, been placed in an advisory position to the district managers in that territory.

ROBERT CHAMBERS, for many years vice president and general manager of the Montgomery Light & Water Power Company, August 2 assumed the general managership of the light and power plant of Richard Tillis, which is now in course of construction at Montgomery, Ala.

D. McFARLAN MOORE has been awarded the John Scott Legacy Medal and premium by the City of Philadelphia upon

the recommendation of Franklin Institute. The award is made in recognition of Mr. Moores' scientific investigations and development of the vacuum-tube lighting system.

H. L. MARKHAM, general manager of the Federal Sign System (Electric) reviewed the growth of the electric sign business at a banquet given at the Moraine Hotel, Highland Park, Ill. Mr. Markham stated in the course of his remarks, that the first electric sign in Chicago was for the Iowa delegation to the National Republican Convention in 1888, and was built to urge the nomination of Senator Allison for president.

WALTER B. GUMP, of Los Angeles, Cal., has been placed at the head of the electrical school which has been started by the Young Men's Christian Association at Los Angeles. Mr. Gump is a graduate of Pratt Institute, Brooklyn, and the Case School of Applied Science, Cleveland, O., and has also the distinction of having worked in the laboratories of Thomas A. Edison at West Orange, N. J. For the past five years he has been on the Pacific Coast, doing engineering work in connection with steam power, hydraulic power and electric transmission. Mr. Gump is also well known as as a contributor to the technical press.

BRITTON J. BUDD, who will have immediate charge of the Chicago Elevated Railways operations, under Samuel Insull, president of the Commonwealth Edison Company, succeeded H. G. Hetzler as president of the Metropolitan Elevated a year and a half ago, when the latter took charge of the Chicago & Western Indiana. Mr. Budd formerly was general manager of the Metropolitan Elevated, in which capacity he attracted the favorable attention of the directors, especially F. A. Delano, president of the Wabash and chairman of the Metropolitan Elevated Board and member of the Board of Governors of the Chicago Elevated Railways.

ASHLEY P. PECK, for six years identified with the Allis-Chalmers Company as sales engineer, connected with the New York office, has recently associated himself with the Terry Steam Turbine Company as district sales manager for the Middle West, with offices at 814 Peoples Gas Building, Chicago, Ill. Mr. Peck, prior to 1902, was actively connected with the machinery sales field of Chicago, and since that date, for three years, was manager of the Milwaukee district sales office of the National Electric Company, going from Milwaukee to the Allis-Chalmers Company at New York in 1905. He is extensively acquainted among the machinery builders, central stations and industrial manufacturers of the Middle West. He is a graduate of Purdue University, class of 1892, and is an associate member of the American Institute of Electrical Engineers.

OBITUARY.

WILLIAM DUNLAP SARGENT, of 51 Remsen Street, Brooklyn, N. Y., died Thursday, August 10, at Somerset, Pa., where he was spending the summer at his country home. Mr. Dunlap, who was one of the most widely and popularly known men in the telephone field, was born in Ligonier, Westmoreland County, Pa., sixty-six years ago. His grandfather, Elijah Sargent, was a Minute Man at Lexington and his father served as a volunteer in the war of 1812. Mr. Sargent was educated in the public schools at Harrisburg, Pa., and became a telegraph operator in the service of the Pennsylvania Railroad. In the civil war he served in the United States Military Telegrgaph Corps at Gen. Burnside's Cincinnati headquarters, and when the war was over he went back to Harrisburg to become manager of the Western Union office there. He was in charge of the telegraph service at the Centennial Exposition in Philadelphia and was present when Prof. Alexander Graham Bell first exhibited his telephone there. Mr. Sargent then became interested in the telephone and entered the business with Thomas E. Cornish of the Bell Telephone Company, of Philadelphia, as general superintendent and general manager. Later he went to Brooklyn and became vice-president and general manager of the New York & New Jersey Telephone Company, and while there was chosen to take charge of its exhibit at the Paris Exhibition in 1889. In 1895 he developed, in connection with John A. Barrett, the dry core paper cable in a continuous lead covering, the cable which is now in standard use in the telephone business. He was very active, also, in the long-distance work of the telephone officials of early days, and is recognized as one of the first and ablest of the pioneers in the telephone field. Mr. Sargent was a director of the National City Bank of Brooklyn and of the Brooklyn Public Library. He was a member of the American Institute of Electrical Engineers, the Brooklyn Institute, the Pennsylvania Society, the New England Society and the Long Island Historical Society. The funeral services were held at the late residence of the deceased, 51 Remsen Street, Brooklyn, N. Y., at three o'clock Saturday afternoon. The remains were taken to Fresh Pond, Long Island, and cremated. Mr. Sargent is survived by a widow and three children.

W. D. SARGENT.

NEW INCORPORATIONS.

KANSAS CITY, MO.—The Western Electric Installation Company has been incorporated with a capital stock of $5,000.

NEW YORK, N. Y.—The Femes Manufacturing Coompany has been incorporated for $10,000 to manufacture electrical supplies. The incorporators are John T. Booth, Otto Foell and G. W. Williams.

NEW YORK, N. Y.—The National Utility Company has been incorporated by John T. Booth, John Dill, Paul Jeppener and Louis V. Hulse to manufacture electrical goods. The capital is $5,000.

NEW YORK, N. Y.—The Lux Manufacturing Company has been incorporated by John T. Booth, Guy V. Williams and Lewis V. Hulse for $25,000. The company will deal in electrical supplies.

CHICAGO, ILL.—C. G. Everson & Company has been incorporated with a capital of $40,000 to manufacture gas and electric fixtures. The incorporators are R. B. Everson, H. V. Willman and C. G. Everson.

JEFFERSON CITY, MO.—Articles of incorporation have been filed by the Electric Equipment Company, of Springfield, with capital stock of $10,000. The incorporators are W. A. Coon, J. T. Coon and H. F. Ford. Z.

LITTLE FALLS, N. Y.—The Electric Supply Company has been incorporated with a capital of $2,500 to manufacture electrical supplies. The incorporators are S. H. Newberry, William H. Coffey, Edward W. Gearhard and Robert D. Dodge.

CHICAGO, ILL.—The Standard Electric Manufacturing Company was recently incorporated with a capital of $2,000 to manufacture electric fixtures and specialties. The incorporators are Earl O. Immel, George B. Lowes and Lester L. Falk.

NEW YORK, N. Y.—The Geyser Electric Company, with chief works in Hartford, Conn., has incorporatetd with a capital stock of $1,500,000 to manufacture electric machinery and apparatus. The incorporators are Heath Sutherland, Frederick E. Anderson, Mabel N. Bacharach of Hartford, Conn.; Andrew R. Nichels of Seattle, Wash.; George S. Landers of Boston, Mass.

NEW PUBLICATIONS.

OBSERVATIONS AT HONOLULU.—The Coast & Geodetic Survey has published the results of observations made at the coast and geodetic survey magnetic observatory near Honolulu, Hawaii, during the years 1907 and 1908.

UNDERWRITERS' RULES.—The National Board of Fire Underwriters has published three booklets of rules and requirements dealing with various phases of installation of preventative apparatus. These deal with "Centrifugal Fire Pumps", "Signaling Systems", and "Municipal Fire-Alarm Systems."

A E G JOURNAL.—The Allgemeine Elektricitäts Gesellschaft, of Berlin, Germany, has begun the publication in English of a new monthly, the *A E G Journal*, the first number of which appeared this July. It is a sixteen-page paper profusely illustrated and in general resembles the German publication, *A E G Zeitung*. The principal articles in the first issue are: "A Tour Through the A. E. G. Turbine Works," "The Dessau-Bitterfeld Electric Railway," "The Hamburg Elevated Railway" and "The A E G at the Munich Exhibition."

COMMERCIAL WOODS OF THE UNITED STATES.—Bulletin No. 95 of the Forest Service, prepared by William L. Hall and Hu. Maxwell, gives an extended account of the uses of cedars, cypresses and sequoias. The uses of white cedar as stated in the bulletin have for many years been diverse, and are further added to now by the requirements of the telephone and telegraph systems. The uses of the other woods are also fully described. An interesting feature of the publication is an extract from "Poor Richard's Almanac" in which Benjamin Franklin gave his ideas of the proper steps to be followed out in preserving the cedar supply.

PROPOSALS.

WIRING.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids for doing electrical work in connectoin with the construction and remodeling of post offices in the following places; bids closing on the dates given below:

Work	Place	Date
Conduits and wiring	New York, N. Y.	August 25.
Conduits, wiring and fixtures	Grand Rapids, Mich.	August 31.
Conduits, wiring and fixtures	Ensley, Ala.	September 7.
Conduits, wiring and fixtures	Pontiac, Ill.	September 8.
Conduits, wiring and fixtures	Athol, Mass.	September 12.

Drawings and specifications may be obtained of the custodians at the various postoffice sites, or at the office of the Supervising Architect.

ELECTRIC-ELEVATOR PLANT.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until September 15, 1911, for an electric-elevator plant in the United States Post Office at Washington, D. C., in accordance with the drawings and specification, copies of which may be obtained at the above office or at the office of the Architects, D. H. Burnham & Company, Chicago, Ill., at the discretion of the Supervising Architect.

INDUSTRIAL ITEMS.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, is distributing to a selected list of consulting engineers a very convenient calendar post card for the asking.

THE AMERICAN STEEL POST COMPANY, Los Angeles, Cal., has mailed a bulletin descriptive of its Carbo steel posts. These posts are also made in long sizes for poles.

THE SCHOOL OF ENGINEERING, Milwaukee, Wis., describes its various courses in a recently published catalog. Illustrations show the electrical laboratory and various other parts of the school.

THE KERR TURBINE COMPANY, Wellsville, N. Y., recently issued catalog No. 19, superseding its bulletin No. 18. This catalog is a thorough treatise on the theory, construction, uses and advantages of small steam turbines for driving generators, pumps, blowers and other small high-speed machines.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., in bulletin No. 4863, describes the Gem lamp. This lamp is intended to replace the carbon lamp as a free renewal lamp. The bulletin compares the carbon with the Gem lamp and shows the advantages derived by the use of the latter.

HIBBARD, SPENCER, BARTLETT & COMPANY, Chicago, Ill., lists a very complete line of electrical suppiles and appliances in a recently distributed catalog. Especial attention is called to the company's shipping facilities, and the promptness with which all orders for goods are filled.

THE WATSON STILLMAN COMPANY, New York, N. Y., describes and illustrates its hydraulic pumps and accessories in catalog No. 81 which has just been distributed. Owing to the fact that the company's products are so extensive, a series of subdivided catalogs, of which the present catalog is one part, has been prepared.

THE ELECTRIC CONTROLLER & MANUFACTURING COMPANY, Cleveland, O., sends the August number of its publication, *Common Sense*. Mention is made of the increasing use of the dynamic breaking controller for hoisting service, which device was perfected about a year and a half ago.

WARREN, WEBSTER & COMPANY, Camden, N. J. have just published an interesting and instructive pamphlet entitled "Modulation System of Steam Heating in the Sumner Apartments." By studying the drawings of the piping which are clearly reproduced, the general method of application of the modulation system to apartment-house heating may be readily understood.

THE ELECTRIC SERVICE SUPPLIES COMPANY, Philadelphia, Pa., calls attention in the July number of the *Keystone Traveller* to three catalogs which have just been issued. These deal with the Garton-Daniels lightning arresters, the "Protected" rail bonds and tools and the "Peerless" armature tools and car-barn appliances. The catalogs are attractively prepared and contain a large amount of useful information.

THE BATES MACHINE COMPANY, Joliet, Ill., describes Cookston cast-iron heaters and receivers in a new twenty-four-page catalog which has just been issued. This heater serves as a purifier, filter, oil-separator and condensation receiver. The new type of oil-separator used on this heater is provided with cut-out valves that permit cleaning of the heater body without interference with the functions of the oil-separator.

THE WESTERN ELECTRIC COMPANY has just completed arrangements whereby it will open a new house at Richmond, Va. A complete stock of telephone apparatus and supplies, power apparatus and general electrical supplies will be carried, enabling the Western Electric Company to give the customers in that territory a very prompt service. H. W. Hall, formerly manager of the Denver branch, will have charge of the Richmond organization.

THE ACHESON GRAPHITE COMPANY, Niagara Falls, N. Y., has published a little booklet entitled "Three Little Stories of Three Big Events and Three Winning Lubricants." In these three events; the Beachey flight under the Niagara arch; the winning of the Marmon *Wasp* in the 500-mile race at Indianapolis; and the winning of the Vanderbilt Cup race by Harry F. Grant; the Acheson Company's product "Oildag" figured prominently.

THE GOULD STORAGE BATTERY COMPANY, Nw York, N. Y., has issued a new bulletin entitled "The Electrical Installations in the Detroit River Tunnel Plant." This bulletin describes the Gould battery and allied regulating apparatus used by the Detroit Edison Company in connection with the haulage of Michigan Central trains through the new Detroit River Tunnel. The engineering in connection with this installation is unusual and of especial interest to those having excessive peak loads. A copy may be obtained by asking for bulletin No. 12.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has distributed copies of bulletins No. 1,080, No. 1,512 and No. 1,623. The former describes various types of alternating current generators and give the present practice of the company in regard to that type of apparatus. Bulletin No. 1,048 is superseded by this publication. Bulletin No. 1,512 contains a description of various types or compound Corliss engines. There is, in the Bulletin No. 1,623, an engineering description of the Priests Rapids development of the Hanford Irrigation & Power Company.

DATES AHEAD.

Indiana Electric Light Association. Annual convention, South Bend, Ind., August 23 and 24.

South Dakota Engineering Society. Annual convention, Lead, S. D., August 23-26.

Institute of Operating Engineers. First annual convention, New York City, September 1-3.

Old Time Telegraphers' and Historical Association and the United States Military Telegraph Corps. Thirtieth annual reunion, Atlantic City, N. J., September 5-7.

Central Electric Railway Association. Annual convention, Cedar Point, Ohio, September 5-8.

Pennsylvania Electrical Association. Annual convention, Conneaut Lake, Pa., September 6-8.

International Association of Municipal Electricians. Annual convention, St. Paul, Minn., September 12-15.

Vermont Electrical Association. Annual meeting, Lake Dunmore, Vt., September 13-14.

International Municipal Congress and Exposition. Chicago, Ill., September 18-30.

Northwest Electric Light and Power Association. Annual convention, Spokane, Wash., September 21-22.

American Electrochemical Society. Twentieth general meeting, Toronto, Canada, September 21-23.

Illuminating Engineering Society. Annual convention, Chicago, Ill., September 25-27.

American Mining Congress. Thirteenth annual meeting, Chicago, Ill., September 25-30.

American Electric Railway Association and affiliated associations. Annual convention, Atlantic City, N. J., October 9-13.

Association of Railway Electrical Engineers. Annual convention, La Salle Hotel, Chicago, November 6-10.

National Electric Light Association. Next annual convention. Seattle, Wash., June 10-14, 1912.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) August 8, 1911.

999,728. TELEPHONE SYSTEM. Frank B. Allen, Elyria, O., assignor to the Dean Electric Co., Elyria, O. Filed Nov. 29, 1909. Has means for connecting the central station circuit and the trunk, has second switching means for connecting the trunk and the called subscriber's line, a source of signaling current in the trunk, a relay in the trunk adapted to connect the source in circuit with a subscriber's line and a key in the trunk controlling the relay, which is imperative until both switching connections are made and the key is operated.

999,729. TELEPHONE SYSTEM. Frank B. Allen, Elyria, O., assignor to the Dean Electric Co., Elyria, O. Filed Dec. 6, 1909. Automatic means are provided for giving a busy back signal to the calling subscriber.

999,735. ELECTRIC CIRCUIT-OPENING DEVICE. Edgar S. Beck, Treichlers, Pa. Filed Nov. 30, 1909. A cell filled with an electrolyte has a stationary electrode immersed therein. A movable electrode is taken out of the electrolyte when the circuit breaker opens, the arc being smothered by a layer of insulating oil on the top of the electrolyte.

999,736. MAGNETIC SEPARATOR. Erastus S. Bennett, New York, N. Y. Filed May 2, 1910. A belt passing around a rotary magnetic body turning in the material to be separated carries away the magnetic portions.

999,745. MECHANICAL MOVEMENT. Tonjes August Carl Both, New York, N. Y., assignor to Ida S. Rosenheim, New York, N. Y. Filed July 2, 1910. Relates to the mechanical details of a lamp socket.

999,746. MECHANICAL MOVEMENT. Tonjes August Carl Both, New York, N. Y., assignor to Ida S. Rosenheim, New York, N. Y. Original application filed July 2, 1910. Divided and this application filed Oct. 4, 1910. Similar to the preceding.

999,749. METHOD OF FORMING COILS FOR ELECTRIC APPARATUS. Lewis W. Chubb, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed June 25, 1907. An aluminum strap bent in the form of an open helix is immersed in a bath of sodium silicate solution. Current is passed through the helix and finally the adjacent convolutions of the helix are pressed into close proximity.

999,754. ELECTRIC RAILWAY. Richard J. Dearborn, Edgewood Park, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed July 6, 1908. The combination with a pair of substantially parallel overhead supply circuit conductors insulated from each other and disposed in the same horizontal plane, of a vehicle having a pair of similar trolleys, each comprising a pantograph or lazytongs supporting structure and a sliding-bow contact shoe, spaced apart longitudinally of the vehicle roof and acting upwardly and outwardly in opposite directions to respectively engage the supply circuit conductors.

999,761. ARC LAMP. George M. Dyott, Pittsburg, and Clarence Carson, Wilkinsburg, Pa., assignors to Westinghouse Electric & Manufacturing Co. Filed April 28, 1906. Has in combination a pair of electrodes, a circuit terminal and a magnet winding for moving the electrodes into engagement with each other and one of them into engagement with the circuit terminal, thereby establishing a circuit through the electrodes. Means are provided for preventing establishment of the circuit until one of the electrodes is moved into engagement with the circuit terminal, and for rendering the magnet winding ineffective when one of the electrodes is moved into engagement with the circuit terminal.

999,762. STORAGE BATTERY AND PROCESS OF TREATING THE SAME. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to Edison Storage Battery Co., West Orange, N. J. Filed Mar. 20, 1908. An active material for the negative electrode of a storage battery comprises electrolytically active finely divided iron and bismuth intimately associated with the active particles.

999,772. COIL-WINDING MACHINE. Charles Le G. Fortescue, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed July 3, 1905. A folder for applying an insulating strip to a strap conductor.

999,780. ELECTRIC FUSE AND FUSE HOLDER. Ford W. Harris, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co., East Pittsburg, Pa. Filed May 9, 1908. A circuit interrupter comprising a continuous magnetizable member and a current-conducting fuse of U shape the depending middle portion of which is surrounded by the magnetizable member whereby the current traversing the fuse passes downwardly and upwardly through the space surrounded by the magnetizable member and produces a magnetic field within which the fuse is partially located.

999,781. MEANS FOR CONTROLLING ELECTRIC CIRCUITS. Gerald W. Hart, West Hartford, Conn., assignor to the Hart Manufaccuring Co., Hartford, Conn. Filed Feb. 21, 1910. Has a switch arm, a pair of main circuit terminals and a solenoid for actuating the switch mechanism to both open and close the circuit, the switch arm being electrically connected to one main circuit terminal when the circuit is both open and closed and to the other when the circuit is closed only. A supplemental contact is engaged by the switch arm when the main circuit is open only.

999,782. SWITCH. Gerald W. Hart, West Hartford, Conn., assignor to the Hart Manufacturing Co., Hartford, Conn. Filed July 7, 1910. A core connected to the switch arm is actuated by a solenoid so that the arm is moved into engagement with the contacts. A lock holds the core in the closed position.

999,792. CONTROL SYSTEM. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed January 5, 1907. Has a number of separately actuated devices and controlling magnet windings, also means operated by each of the devices to provide shunts for the windings pertaining to all the other devices.

999,800. ELECTRICAL MEASURING INSTRUMENT. Samuel M. Kintner, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed Oct. 3, 1905. Comprises stationary and movable members arranged in electrostatic relation, one or more condensers connected in the series circuit, a body of insulating liquid in which the parts are immersed, and means for maintaining the liquid under compression.

999,808. SWITCH. Henry E. Leppert, New Britain, Conn., assignor to the Hart Manufacturing Co., Hartford Co. Filed Oct. 19, 1910. One of the two movable posts is provided with a recess, the other having a cam surface. A spring-actuated detent in the recess of the part is designed to partially enter the recess in the stationary member.

999,811. ELECTRIC GENERATOR, MOTOR AND SUCH LIKE. Birger Ljungstrom, Stockholm, Sweden. Filed Apr. 1, 1908. Combines with the rotor a commutator, a mounting independent of the rotor, means to drive the commutator from the rotor, and means to yieldingly electrically connect the rotor and commutator.

999,813. ARTIFICIAL LIGHT-DIFFUSING APPARATUS. North Losey, Indianapolis, Ind. Filed June 21, 1909. A focusing reflector and a diffusing reflector are combined in an electric chandelier.

999,833. ELECTROMAGNETIC GRAPPLING-TOOL. Constantine M. Miller, Chicago, Ill., assignor to the Meaker Co. Filed May 12,1910. An electromagnet is attached to a rod in convenient form for extracting small iron objects.

999,851. ELECTRIC SWITCH. Granville E. Palmer, Winchester, Mass. Filed May 3, 1910. Comprises a plurality of pairs of terminals, a switch arm for each pair of terminals, a universal bar connecting the switch arms, a guide carrier having guides for the bar, a clutch having a stationary abutment carried by the guide carrier, a movable abutment and an intermediate member, this intermediate member being carried by the bar and carrying a detent adapted to secure the intermediate mmber to the abutments alternately.

999,859. PORTABLE TELEPHONE. Niels Pedersen, Genoa, Ill., assignor to Cracraft-Leich Electric Co., Genoa, Ill. Filed June 4, 1909. Has a plurality of independent radial arms for supporting telephone apparatus provided in the base and secured to the stem.

999,860. ADJUSTABLE ELECTRIC LAMP. Ward S. Perry and Julius O. Eis, Chicago, Ill., assignors to Vesta Accumulator Co., Chicago, Ill. Filed Nov. 15, 1909. An electric lamp whose rays are reflected by a parabolic reflector; may be shifted backward or forward as desired along the axis of the parabola.

999,870. ELECTRICAL APPARATUS. Karl C. Randall, Edgewood Park, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed July 28, 1909. A pump forces the oil through a chamber containing a hygroscopic material, constantly supplying dehydrated oil to the transformers.

999,874. WATCHMAN'S CLOCK. Richard C. Rose, Osceola, Ark. Filed Jan. 18, 1911. Electromagnetic contactors and an electric bell are included in the clock circuit.

999,875. PROTECTIVE DEVICE FOR ELECTRICAL CIRCUITS. Girard B. Rosenblatt, Butte, Mont., assignor to Westinghouse Electric & Manufacturing Co. Filed Apr. 4, 1906. A fusible conductor having terminal pieces of hooked shape engages with a notched terminal. When the conductor end fuses the entire piece is pulled away by means of a coiled spring.

999,883. ELECTRIC SWITCH. Franklin Schneider and John C. Dunfee, Cleveland, O., assignors to the Van Dorn & Dutton Co., Cleveland, O., a corporation of Ohio. Filed Dec. 8, 1910. Relates to details of construction of a special switch.

999,890. OSCILLATING MOTOR-DRIVEN FAN. Harry M. Shedd, Roselle, N. J., assignor to Westinghouse Electric & Manufacturing Co. Filed Nov. 29, 1909. An electric fan is oscillated by means of an eccentrically mounted disc working in co-operation with a cam surface on the fan base.

999,893. WINDING COIL FOR DYNAMO-ELECTRIC MACHINES. Charles E. Skinner, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co., East Pittsburg, Pa. Filed Oct. 7, 1908. A fireproof coil for electrical apparatus comprises a plurality of turns of conducting material separated by metal form treated to produce an insulating coating or film on the surface.

999,894. STARTING SYSTEM FOR GAS ENGINES. Harrison E. Slaughter, Los Angeles, Cal. Filed May 3, 1909. Relates to details of a low-tension starting system for explosion engines.

999,927. TELEPHONE SYSTEM. Harry G. Webster, Chicago, Ill., assignor, by mesne assignments, to Kellogg Switchboard & Supply Co. Filed July 16, 1906. Comprises a normally disconnected talking contact of a spring jack associated with the telephone line, a plug, a cord circuit, a battery associated with the circuit adapted to be included in the metallic circuit of the line and constituting the sole source for furnishing current for talking purposes, a second source of current, a cut-off relay operated from the second source of current over a portion of the talking circuit, and means whereby the currents from the source through the relay are restrictetd to circuits local to the exchange.

999,928. ARMATURE WINDING FOR ELECTRIC MOTORS. John E. Webster, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed June 19, 1905. The combination with a commutator cylinder of an armature core and a winding comprising a plurality of coils the lengths of the end portions of which are unequal and alternate groups of the longer end portions of which are bent inwardly to a different are from that of the remaining groups.

999,935. CONSTRUCTION OF ELECTRIC MOTORS AND DYNAMOS. Charles E. Willey, Louisville, Ky., assignor to Jas. Clark, Jr., Electric Co., Louisville, Ky. Filed Nov. 16, 1910. Pole pieces and frame have registering longitudinal keyways, the pole pieces being firmly held in place by a bolt.

999,945. HEAD-ELECTRIFYING DEVICE. Hermann Aub, Munich, Germany. Filed July 19, 1910. A spring frame with terminals and contact pads is designed to fit on the head.

999,947. MOTOR CONTROLLER. Thomas E. Barnum, Milwaukee, Wis., assignor to the Cutler-Hammer Mfg. Co., Milwaukee, Wis. Filed Nov. 8, 1909. Co-operating contact members move relatively to one another, one of the members being movable at will. Electroresponsive means are provided for operating the other of said members and an escapement mechanism fixed for controlling the last mentioned member to cause it to operate in synchronism with the motor.

999,975. METHOD OF PRINTING BY SOUND. Arthur C. Fergu-

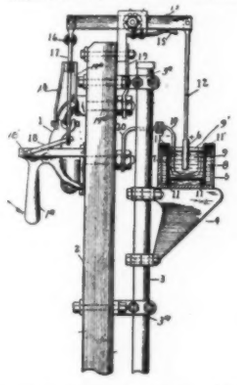
son, Brooklyn, N. Y., assignor of eleven-sixteenths to Lyman C. Smith, Syracuse, N. Y. Filed Jan. 21, 1903. Consists in utilizing a succession of sound waves as a motive force to initiate the operation of mechanism actuated by a separate source of energy for printing a legible character corresponding to certain tone characteristics of the waves.

999,977. VOLT AND AMMETER. Harold Fish, Stratford, Conn. Filed Sept. 6, 1910. A pair of arms pivoted to a support carry movable terminals from the poles of the battery, engaging them with the terminals of the meter.

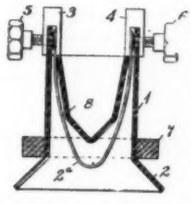
999,987. APPARATUS FOR PRODUCING HIGH-FREQUENCY CURRENTS. Rudolf Goldschmidt, Darmstadt, Germany. Filed Aug. 26, 1908. Comprises stator and rotor members provided with windings having mutually inductive relation, means for supplying an exciting current to produce a magnetic field in one of the members, means for rotating the rotor, thereby inducing currents of higher frequency in the other member and means for transferring the energy of the last-named currents to the inducing member and causing an inductive field of the higher frequency to react upon the induced member to thereby produce currents of still higher frequency, the reactions thus effecting an increase of frequency of the initial exciting currents.

999,994. ENGINE STOP. Arthur S. Hawks, Bethlehem, Pa. Filed July 8, 1910. A pin carried in a hole in the flywheel is thrown outward and an electric circuit opened when the flywheel exceeds a certain predetermined speed.

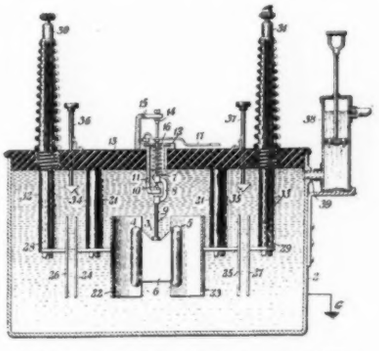
999,998. ELECTRIC LAMP FIXTURE. William C. Hine, Conneaut, O. Filed Dec. 12, 1910 A combination fixture for supporting an electric lamp and shade.



999,735.—ELECTRIC CIRCUIT OPENER.



999,780.—ELECTRIC FUSE AND HOLDER.



999,800.—MEASURING INSTRUMENT.

1,000,031. CONNECTOR. Emil Mattman, Milwaukee, Wis., assignor to Allis-Chalmers Co. Filed Sept. 13, 1909. Has a plurality of terminals one of which is stepped and cut to form a yielding projection.

1,000,034. TROLLEY HARP. James A. Norton, Wilkesbarre, Pa., assignor of one-half to William R. Raeder, Wilkesbarre, Pa. Filed Dec. 4, 1909. One of the arms has a guideway and slot into which one end of the trolley-wheel shaft slips. The shaft is held in place by a beveled guide bolt.

1,000,039. ELECTRICALLY OPERATED SCORE-BOARD. Samuel Arthur Redding, Atlanta, Ga. Filed June 9, 1909. Numbers indicating the score are displayed on a large board by means of an electrical control system and a small control board.

1,000,045. CORD ADJUSTER. William C. Spicer, Penacook, N. H. Filed Nov. 17, 1910. A spring-drum device for adjusting the length of lamp chord.

1,000,052. ELECTRIC SWITCH. Chester H. Thordarson, Chicago, Ill. Filed June 27, 1910. A pivoted switch arm is altternately acted upon by two plungers which are raised by solenoids.

1,000,061. DYNAMO-ELECTRIC MACHINE. Robert B. Williamson, Norwood, O., assignor to Allis-Chalmers Co. and the Bullock Electric Manufacturing Co. Filed Nov. 1, 1907. Renewed Feb. 16, 1911. Has a collecting device electrically connected to the rotatable element, a shaft carrying this rotatable element and the collecting device and slidable endwise relatively to the fixed element and the collecting device, and means for preventing the shaft from so sliding save under predetermined conditions.

1,000,066. DYNAMO-ELECTRIC MACHINE. Bernard Arthur Behrend, Norwood, O., assignor to Allis-Chalmers Co. and the Bullock Electric Manufacturing Co. Filed Nov. 27, 1905. The stationary armature comprises a hollow cylindrical core and end members, a plurality of radial ribs in one of the end members, a supporting ring or band mounted on the inner faces of the ribs, armature coils having end-turns, and a plurality of end-turn supports mounted on the ring or band.

1,000,071. SYSTEM OF CONTROL. Robert W. Cheney, Norwood, O., assignor to Allis-Chalmers Co. and the Bullock Electric Mfg. Co. Filed Dec. 31, 1906. In a fluid pressure system, the combination of a reservoir, and a valve arranged to open in the same way when the pressure in the reservoir either rises above or falls below predetermined limits.

1,000,074. ELECTROMAGNETIC SWITCH. Henry B. Collier, Prairie Grove, Ark. Original application filed Sept. 14, 1908, Serial No. 452,906. Divided and this application filed Sept. 15, 1909. A pair of plates extend upward from a base, a pair of magnets being mounted between the plates. Insulating bearings are carried by the plates, a frame sliding in the insulating bearings. There is also a bar provided with an insulating terminal, an armature carried by the frame and lying adjacent the cores of said magnet, a spring contact mounted on the base in the path of the insulating terminal and constantly bearing against the terminal to urge the armature away from the cores, and a second contact fixed to the base and lying in the path traversed by the spring contact as the latter is moved under the influence of the magnets.

1,000,077. TRANSMISSION SYSTEM. George C. Cummings, Western Springs, and Archibald Wray, Chicago, Ill. Filed Mar. 3, 1909. Includes a line circuit leading from a transmitting to a plurality of receiving stations.

1,000,078. SYSTEM FOR TRANSMITTING INTELLIGENCE. George C. Cummings and John A. Kick, Western Springs, Ill. Filed June 16, 1909. Includes a transmission line extending from a transmitting station to a receiving station, a series of relays operating in succession and each serving to cause the impression of a current wave upon the line and together the impression of waves in fixed order, means for effecting modification of normal wave formation and restricted to operate within the periol of formation of the wave undergoing modification, and electromagnetic responsive apparatus at the receiving station.

1,000,101. ELECTRICAL ATTACHMENT PLUG. Gustave C. Marx, Elizabeth, N. J., assignor to Diehl Manufacturing Co. Filed Sept. 28, 1906. The members of a plug and socket are formed of relatively yielding interengaging parts by which they are frictionally secured in operative contact relation.

1,000,109. MACHINE FOR COVERING OR INSULATING WIRE WITH YARN OR ITS EQUIVALENT. Donald Noble, Bridgeport, Conn. Filed Aug. 18, 1910. The combination of the spinning head which carries the yarn cop with a suitable tension acting thereagainst, means for revolving the head, rolls carried by the head, these rolls rotating independently and operating always with a tension to pay out to said instrumentalities an amount of yarn in excess of that needed.

1,000,116. TROLLEY. George E. Palmer, Chicago, Ill. Filed Jan. 14, 1911. The trolley wheel is mounted on a short rod which works in a hollow space at the end of the trolley pole. A spring pressing against the end of the rod tends always to push it outward.

1,000,123, SWITCHBOARD CIRCUIT AND EXCHANGE APPARATUS FOR TELEPHONES. Homer J. Roberts, Evanston, Ill., assignor to Homer Roberts Telephone Co. Original application filed Sept. 5, 1905. Divided and this application filed Oct. 31, 1906. Combines a plurality of connecting cords and corresponding cord keys controlling the cord, a line drop for each connection jack, a bus-line connected to the respective line jacks and cords and including said line drops, clearing-out circuit connections at the switchboard, a master key set controlling the various circuit connections, and contact devices included in the bus-line and controlled by the master key.

1,000,129. ILLUMINATING DEVICE. Charles A. Taepke, Chicago, Ill., assignor to M. O'Brien & Son, Chicago, Ill. Filed Feb. 19, 1909. Rays from electric lamps are projected through a slot on the object to be illuminated.

1,000,141. ELECTRICAL FITTING. Harry C. Barber, North Haven, Conn., assignor to New Haven Electric Manufacturing Co., North Haven, Conn. Filed May 8, 1911. Comprises a body having a centrally arranged opening, a hole on opposite sides of the open-

ing and a groove in opposite walls of the opening in radial line with said holes.

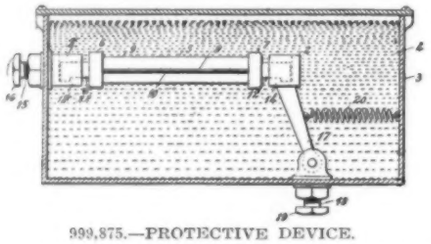
1,000,154. SAFETY APPARATUS FOR AMUSEMENT OR OTHER AUDITORIUMS. John H. Crosier, Philadelphia, Pa., assignor of six-tenths to George N. Powell, Pittsburg, Pa. Filed Mar. 19, 1909. Renewed Nov. 18, 1910. A catch locks the projection-lamp circuit closed, the release of this switch being effected by an electro-magnet. Means are provided for energizing the magnet on the occurrence of abnormal conditions.

1,000,158. ELECTRIC SWITCH. Willard E. Dow, Braintree, Mass. Filed Aug. 6, 1909. Has a movable arm, a support and a recess in the path of the arm, means on the arm for engaging the recess and a removable means for normally partially closing the recess to permit the movement of the arm while leaving a shallow recess sufficient for indicating a position of the arm.

1,000,161. METHOD OF AND MEANS FOR CONTROLLING ELECTRIC MOTORS. Arthur C. Eastwood, Cleveland, O., assignor to the Electric Controller and Manufacturing Co., Cleveland, O. Filed Feb. 8, 1910. Consists in connecting the armature and series field windings of the motor in series with each other and in series with a resistance, and reducing the resistance to increase the speed of the motor for one direction of motion, and connecting the armature and series field windings in parallel circuits, each containing a resistance, and increasing the resistance in the field circuit to increase the speed of the motor for the opposite direction of motion.

1,000,183. ELECTRIC CEILING FAN. Ercole Marreli, Milan, Italy. Filed Mar. 23, 1908. Has a stationary shaft and a rotating casing to which the fan blades are attached.

1,000,189. TROLLEY. Abram Nash, Chicago, Ill., assignor of one-half to W. A. Prater, Chicago, Ill. Filed Aug. 15, 1910. The



999,875.—PROTECTIVE DEVICE.

axle of the trolley wheel is free to move up and down in vertical ways. A spring held in a downwardly projecting cylinder forces the wheel against the trolley wire.

1,000,206. STERILIZING FAUCET. Edward Charles Spurge, Niagara Falls, N. Y. Filed Jan. 10, 1911. The electric circuit is closed and the water valve is opened with one movement. Pipes from an ozonifier in the electric circuit lead to the water tap, the ozone coming in contact with the water just before it leaves the tap.

1,000,208. LIQUID GAUGE FOR TANKS. Edward C. Swett, Beloit, Wis. Filed July 25, 1910. Comprises a liquid fuel receptacle, a float movable therein, a series of electrical terminals against which said float is adapted to contact, circuits closed by the float, a series of electro-magnets energized by the closing of the circuits, a rotatable shaft, disks and an indicating pointer fixed thereto, a series of pivotal jointed links mounted upon the disks and adapted to be successively drawn into contact with the electro-magnets as the float falls and comes in contact with various terminals, and a dial adjacent to which the pointer moves.

1,000,231. LAMP BOX. William Robert Bowles, Hopkinsville, Ky. Filed Oct. 10, 1910. A box with a sheet-metal base contains a plurality of lamps.

1,000,248. APPARATUS FOR SHORTENING ELECTRIC WAVES. Carlo Ferrari and Michele Pizzuti, Naples, Italy. Filed Apr. 14, 1910. Apparatus for protecting electric installation from excessive accidental voltages comprises in combination a self-induction, a capacity, and discharge gaps, the self-induction and one armature of the capacity being arranged in series with and between a line and an installation to be protected, the other armature of the capacity being connected to earth, and the discharge gaps being connected on the one side to different points on the self-induction and armature which is in series with the line and on the other side to earth, while the product of said self-induction and capacity per unit of length is greater than the product of the self-induction and capacity of the line per unit of length.

1,000,294. ELECTROMAGNETIC VIBRATOR FOR LOCAL APPLICATION TO THE PERSON. Augustus Rosenberg, London, England. Filed Feb. 19, 1910. Operates by means of an electro-magnet and a vibrating core.

1,000,300. TESTING INSTRUMENT. Harry W. Secor, Trenton, N. J. Filed Jan. 11, 1910. Comprises two incandescent electric lamps, a cap secured to the base having oppositely positioned plug openings, a bar carried by the cap having a jack spring at each end proximal to said plug openings, a jack spring adjacent to each of the bar springs, and an electric conductor extending from the bar to each of the lamps.

1,000,314. TELEGRAPHIC INSTRUMENT. Gustave A. Zundel, New York, N. Y., assignor to J. H. Bunnell & Co., New York, N. Y. Filed Dec. 7, 1910. A telegraph sounder lever, uprights supporting the same, springs carried by the latter on which said lever has its bearings, and means for depressing the lever against the action of the springs to vertically adjust its axis of oscillation.

1,000,320. MERCURY-CONTACT BREAKER. Leonhard Baumeister, Erlangen, Germany, assignor to Kny-Scheerer Co., New York, N. Y. Filed Nov. 12, 1910. A receptacle contains a layer of electrically conducting liquid, a contact member being adapted to make and break contact with the liquid. A bell is disposed over the liquid in which the contact member works and a liquid is disposed with this bell being adapted to expand when a spark is created by the breaking of the contact between the conducting liquid and the contact member, forcing the conducting liquid away from the contact member.

1,000,330. SECONDARY OR STORAGE BATTERY. Norman Dodge, Philadelphia, Pa., assignor to the Electric Storage Battery Co., Philadelphhia, Pa. Filed June 9, 1904. Consists of a sheet of fine-grain wood having its natural structure and containing its cellulose and fibrous constituents and constituting a diaphragm impervious to battery sediment and primarily deprived of such of its constituents as would deleteriously attack lead when subjected to electrolytic action and retaining such of its constituents as beneficially affect a negative pole plate.

1,000,335. THERMO ELECTRIC FOUNTAIN SYRINGE. Norman E. Houser, St. Louis, Mo. Filed May 24, 1910. Is provided with an electric heating element.

1,000,340. TELEPHONE SYSTEM AND SIGNALING APPARATUS. Frederick R. Parker, Chicago, Ill. Filed Nov. 24, 1906. Comprises a source of signaling current, switching mechanism for applying current of requisite polarity to the line, and a substation on the line equipped with a polarized signaling device, a condenser, and switching mechanism adapted to be actuated by the device to open the circuit of the line and close the condenser circuit through the device, intermittently.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired August 14, 1911:

524,305. ARC-LAMP POST. Richard R. Bowker, New York, N. Y.
524,343. ELECTRICAL CONDUCTORS. Edwin D. McCracken, Alpine, N. J.
524,357. ELECTRIC ARC LAMP. Otto H. Swoboda, New York, N. Y.
524,366. ELECTRIC-RAILWAY SYSTEM. Theodore B. Wilcox and Henry Wilcox, Newark, N. J.
524,367. ELECTROMAGNETIC CONTACT-MAKING DEVICE FOR ELECTRIC RAILWAY SYSTEMS. Theodore B. Wilcox and Henry Wilcox, Newark, N. J.
524,373. REGULATION OF DYNAMO-ELECTRIC MACHINERY. Edward M. Bentley, Boston, Mass.
524,374. BATTERY CHANGER FOR ELECTRIC CIRCUITS. Charles Bernhardt, Chicago, Ill.
524,378. SYSTEM OF ELECTRICAL DISTRIBUTION. Thomas A. Edison, Llewellyn Park, N. J.
524,381. SYSTEM OF POWER DISTRIBUTION AND REGULATION. John W. Gibboney, Lynn, Mass.
524,385. CONTROLLER FOR ELECTRIC MOTORS. Joseph H. Jenkins, Lynn, Mass.
524,386. ELECTRIC TIME RECORDER. Harry T. Johnson, Elizabeth, N. J.
524,387. TELEPHONE SWITCH. Harry T. Johnson, Elizabeth, N. J.
524,388. ELECTRIC SEARCHLIGHT. Edward R. Knowles, Middletown, Conn.
524,396. CONTROLLER FOR ELECTRIC MOTORS. William D. Potter, Lynn, Mass.
524,407. ELECTRIC MOTOR. William L. Silvey, Dayton, Ohio.
524,426. ELECTROMAGNETIC MOTOR. Nikola Tesla, New York, N. Y.
524,434. CONDUIT-CLEANING DEVICE. Charles O. Ehlert, New York, N. Y.
524,480. TELEPHONIC SYSTEM. Henry A. Chase, Boston, Mass.
$24,524. TELEPHONE TRANSMITTER AND RESISTANCE VARYING METHOD THEREFOR. Frank R. Colvin, New York, N. Y.
514,532. SWITCH FOR ELECTRIC RAILWAY CARS. Timothy A. Remsen, Brooklyn, N. Y.
524,533. DYNAMO-ELECTRIC MACHINE OR ELECTRIC MOTOR. Alonzo B. See and Walter L. Tyler, Brooklyn, N. Y.
524,548. AUTOMATIC ELECTRIC SIGNALING DEVICE. Edward A. Hermann, St. Louis, Mo.
524,630. AUTOMATIC CIRCUIT-BREAKER. Anatole C. Carlsen, Portland, Me.
524,646. ELECTRIC HEATER. Charles H. Newbury, St. Paul, Minn.
524,656. ELECTRICAL STORAGE BATTERY. Burton C. Van Emon, San Francisco, Cal.
524,664. ELECTRIC BELT. Flora A. Brewster, Baltimore, Md.